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Activation of New Functionality to Enterprise Resource Planning Systems: Case TeliaSonera's SAP Enhancement Packages

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Abstract

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Enterprise resource planning (ERP) systems have been vital to both large and small businesses for a long time due to their efficient data processing capabilities. The common way to develop ERPs, or in other words activate new functionalities to them, been upgrading the latest ERP version or tailoring the codebase of the existing ERP. From a large enterprise perspective, the version upgrades which require a high workload have been available too seldom, whereas tailoring of ERPs has been considered too expensive.

The goal of the thesis was to find out the best functionality to TeliaSonera within Human Capital Management (HCM) sector by SAP ERP's Enhancement Packages (EHPs). Functionalities, also known as business functions, were limited inside the SAP HCM sector only because the sample would otherwise have been too wide. EHPs are SAP's way to deliver new functionalities to SAP ERP 6.0, which is designed primarily for the needs of large enterprises.

The research process of the best functionality started by investigating what functionalities the HCM sector includes. After that the number was reduced by open interviews with the representative of TS. When the best functionalities had been found out, they were scored by a structured question form.

The results showed that the best functionality for TS inside the HCM sector was Employee Self-Services on Webdynpro ABAP. However, the selection was not easy. The challenges during the selection process were irrelevant features, within most of the functionalities, for TS's needs, several integration points of functionalities, and also a highly speculative comparison between functionalities. Identifying and understanding the challenges will help TS to find out the best functionalities also from the other sectors than the HCM.

Keywords	ERP, SAP, EHP

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Tiivistelmä

Tekijä Otsikko Sivumäärä Aika	Miika Kainulainen Uusien toiminnallisuuksien aktivointi toiminnanohjausjärjestelmiin: Tapaus TeliaSoneran SAP-parannuspaketit 50 sivua + 4 liitettä 1.4.2012
Tutkinto	insinööri (AMK)
Koulutusohjelma	tuotantotalous
Suuntautumisvaihtoehto	toiminnanohjausjärjestelmät
Ohjaajat	Chief Architect Mika Karvinen lehtori Erkki Koskela

Toiminnanohjausjärjestelmät ovat jo pitkään olleet elinehto sekä suur- että pienyrityksille niiden mahdollistaman tehokkaan tiedonhallinnan ansioista. Yleinen tapa kehittää niitä, toisin sanoen hankkia uusia toiminnallisuuksia, on ollut tavallisesti joko kokonaan uuden toiminnanohjausjärjestelmä version implementoiminen tai vanhan version koodipohjainen räätälöiminen. Suuryritysten näkökulmasta versiopäivitykset ovat yleensä olleet liian harvoin toistuvia ja silloinkin työläitä, kun taas toiminnanohjausjärjestelmän räätälöinnin on katsottu usein itsessään olevan liian kallista.

Insinöörityön tavoitteena oli selvittää SAP-toiminnanohjausjärjestelmän parannuspakettien avulla, mikä HCM (Human Capital Management) -sektorin toiminnallisuus sopisi parhaiten TeliaSoneran tarpeisiin. SAP jakaa parannuspakettiensa toiminnallisuudet eri toiminta-alueille eli sektoreille siten, että kukin SAP-moduuli, kuten esimerkiksi finanssitoiminnot, saavat omat toiminnallisuutensa. SAP:n käyttäjän näkökulmasta toiminallisuuksia kannattaa aktivoida vain niiltä sektoreilta, joiden vastaavat SAP-moduulit ovat jo ennestään käytössä kyseisessä yrityksessä. Insinöörityössä rajattiin toiminnallisuuksien kartoitus vain HCM-sektorille, koska otos olisi muuten ollut liian laaja. Parannuspaketit taas ovat SAP:n tapa tuoda uutta toiminnallisuutta SAP ERP 6.0 -nimiselle toiminnanohjausjärjestelmälle, joka on suunnattu ensisijaisesti suuryritysten tarpeisiin.

Parhaan toiminnallisuuden selvitysprosessi eteni siten, että ensin kartoitettiin, mitä toiminnallisuuksia SAP:n HCM-sektori sisältää, jonka jälkeen niiden määrää ruvettiin vähentämään avointen haastattelujen perusteella TeliaSoneran edustajan ja työn ohjaajan Mika Karvisen kanssa. Kun toiminnallisuuksien parhaimmisto oli saatu selville, ne pisteytettiin strukturoidun kysymyslomakkeen avulla.

HCM-sektorin paras toiminnallisuus, Employee Self-Services on Webdynpro ABAP, TeliaSoneran tarpeisiin saatiin selvitettyä. Haasteina valintaprosessin aikana olivat kuitenkin useimpien toiminnallisuuksien kytkeytyminen toisiinsa, toiminnallisuuksien epärelevantit ominaisuudet TeliaSoneran kannalta sekä toiminnallisuuksien vertailtavuuden hankaluus. Näiden haasteiden tunnistaminen auttaa TeliaSoneraa jatkossa löytämään parhaat toiminnallisuudet myös muilta SAP:n toiminta-alueilta kuin vain HCM-sektorilta.

Avainsanat	ERP, SAP, EHP, toiminnanohjausjärjestelmä

Contents

Appendices

Abbreviations and Terms

ABAP — Advanced Business Application Programming is a programming language created by SAP AG and it is utilized in the SAP system.

APO — Advanced Planner and Optimizer is a component of SCM in the SAP system.

ASP — Application Service Provider was a service model of cloud computing, the predecessor of Software as a Service, in the 1990s.

AX — The abbreviation comes from the term Axapta which is the name of Microsoft Company's former ERP system.

BFP — Business Function Prediction is a service of SAP ERP 6.0 whose goal is to find the most relevant functionalities to the customer company based on their earlier usage of SAP ERP 6.0.

BPaaS — Business Process as a Service is a service model of cloud computing which provides the whole business process over the Internet.

Business function — The term is often used by SAP AG, which is a synonym of functionality.

CAGR — Compound Annual Growth Rate is a term for the annualized gain of an investment over a given time period.

CATS — Cross-Application Time Sheet is a component of the SAP system which is utilized to record working times of the employees.

C-commerce — Collaborative commerce is a business strategy which tries to enhance the communication between the supply chain partners.

CRM — Customer Relationship Management is individual software or a module of ERP system which is utilized in managing sales processes.

EBS — E-Business Suite is Oracle's ERP suite.

EHP — Enhancement Package is a light version upgrade developed by SAP AG which enhances SAP ERP 6.0 with its new functionalities.

ERP — Enterprise Resource Planning is a system which integrates the other systems seamlessly together.

ERP II — Enterprise Resource Planning II refers to the original ERP which is later enhanced by expanding its value chain from the inside of the enterprise to the outside.

ERP III	Enterprise Resource Planning III is a term of the newest ERP system which is able to increase the customer centric value by its latest technology enhancements.
ES	Enterprise systems are the IT operations unit of TS which develops IT systems to the internal customers of TS, also known as a PITA team.
ESS	Employee Self-Services is a suite of applications in the SAP system where employees can maintain their personal data.
Feature	A sub-component of functionality which describes at a more detailed level what a particular functionality executes. All SAP EHP functionalities consist of one or more features.
Functionality	A component of version upgrade which is designed and targeted to enhance a particular business process in the ERP system.
HCM	Human Capital Management is the newer term of human resources.
IaaS	Infrastructure as a Service is a service model of cloud computing which enables provision of computing capability.
Java	The most common programming language.
MRP	Material Requirements Planning is an inventory control system which is the predecessor of MRP II and ERP.
MRP II	Manufacturing Resource Planning is a system of manufacturing company which is the predecessor of the ERP system.
MSS	Manager Self-Services is a tool for managers to communicate with their relevant subordinates in the SAP system.
NIST	National Institute of Standards and Technology is a measurement standards laboratory.
NWBC	NetWeaver Business Client is the new way to use SAP Employee Self-Services without SAP NetWeaver Portal.
PaaS	Platform as a Service is a service model of cloud computing which provides a computing platform where the user can develop applications.
PITA	Process and IT Alignment means TS's internal customers who are the decision-makers of TS concerning global operations.
Project team	The term refers to a certain group of consultants who were finding out the best SAP EHP functionalities for TS regardless the thesis.
Roadmap	The term refers to the schedule of functionalities concerning TS.

SaaS Software as a Service is the most common service model of cloud computing which grants an access to the software through the Internet browser.

Sandbox The test environment, which is often the virtual system, is the place where unverified programs can be tested without risking the functioning of the actual system.

SAP NetWeaver Portal
The traditional way to use SAP Employee Self-Services.

SCM Supply Chain Management includes multiple processes which are needed in order to make finished goods from raw materials. In the SAP system, SCM is a module of the SAP Business Suite software.

Sector The term refers to the categorization of functional areas such as Financials, HCM or Procurement in the SAP system.

SRM Supplier Relationship Management utilizes the information of suppliers. In the SAP system, SRM is a module of the SAP Business Suite software.

STVN SAP Talent Visualization by Nakisa is organization visualization software.

Transaction code
The term means a combination of letters and numbers which is utilized in the SAP system to move swiftly from one business process to another.

TS TS is abbreviation of TeliaSonera.

TS representative
The term refers to a certain consultant who was interviewed during the study.

UI User Interface is often referred as the view from the screen of the computer.

1 Introduction

Enterprise Resource Planning (ERP) systems have been integrating and sharing the business data of companies since the mid-1990s when the technology started to become common in the business world. After the millennium, many large companies had already invested in to ERP systems by implementing the core ERP, and thus shifted to develop them. ERP vendors answered to the development needs of companies by offering multiple business modules, for instance Customer Relation Management (CRM), around the core ERP. However, when a company wanted to develop or add a new functionality to its ERP systems modules, there was practically one way to do it: by tailoring the desired functionality to the codebase accordingly. However, this way is often expensive and time consuming to any firm.

Activating a new functionality to an ERP system is not the same as support packages, bug fixes, minor updates or even large version upgrades. It is more like a light version upgrade which is usually designed to serve very specific business needs. The purpose of the new functionalities is therefore to minimize the development or tailoring costs of ERP systems from a user's point of view, and on the other hand, engage the user to become even more dependent on a particular ERP system. Adding new functionality is like a quid pro quo situation, or a favor for a favor, between the ERP vendor and the user.

This study was ordered by TeliaSonera (TS) Finland Plc. TS is Europe's the fifth largest telecom operator which provides network access and telecommunications services. The company was founded in 1853 and it employed 28776 people at the end of the year 2010. [1.] TS upgraded its SAP ERP system's EHP version from the third to the fifth during the autumn 2011. The new package, EHP5, consists of around 600 individual functionalities all in all, which a user can activate one by one after their installation. This leads to the fundamental question: what functionalities should TS activate to gain maximum advantage?

Before this study the EHP concept itself is quite unfamiliar to most of TS's employees because EHP3 was installed around the same time when TS upgraded its older SAP

ERP version to the 6.0 version. The version upgrade took most of the attention of TS employees, and EHP3 was left in the darkness. In order to find the best functionality, it will be necessary to interview some of the TS's employees who use SAP on a daily basis in their work. Collecting, comparing and combining the information from interviewees and representing the results to them are the most fundamental goal of this study. Hopefully the study will help TS employees to widen their knowledge about EHP functionalities and the EHP concept itself.

TS use many different programs within their HR departments in different countries. If I can find just one SAP ERP functionality which will erase the need for one of the other programs, and therefore cut costs, this study would be a great success. However, the previous goal has a slight chance to come true. Rather, the study aims to provide more knowledge of SAP functionalities and their possibilities to TS's employees in all departments, especially to TS's IT Solution Managers.

Structure of This Study

This study concentrates on developing ERP systems by adding new functionality to them. One of TS's ERP systems, SAP ERP 6.0, plays major role in this study because it helps to understand the developing process of adding new functionality in general. In this study, activating new functionalities to SAP ERP was limited within SAP's HCM-sector due to the scope of the Bachelor's Thesis.

Figure 1 is summarizes the structure of this study. The blue boxes represent the critical path of the study, whereas the white ones concentrate on the theoretical background.

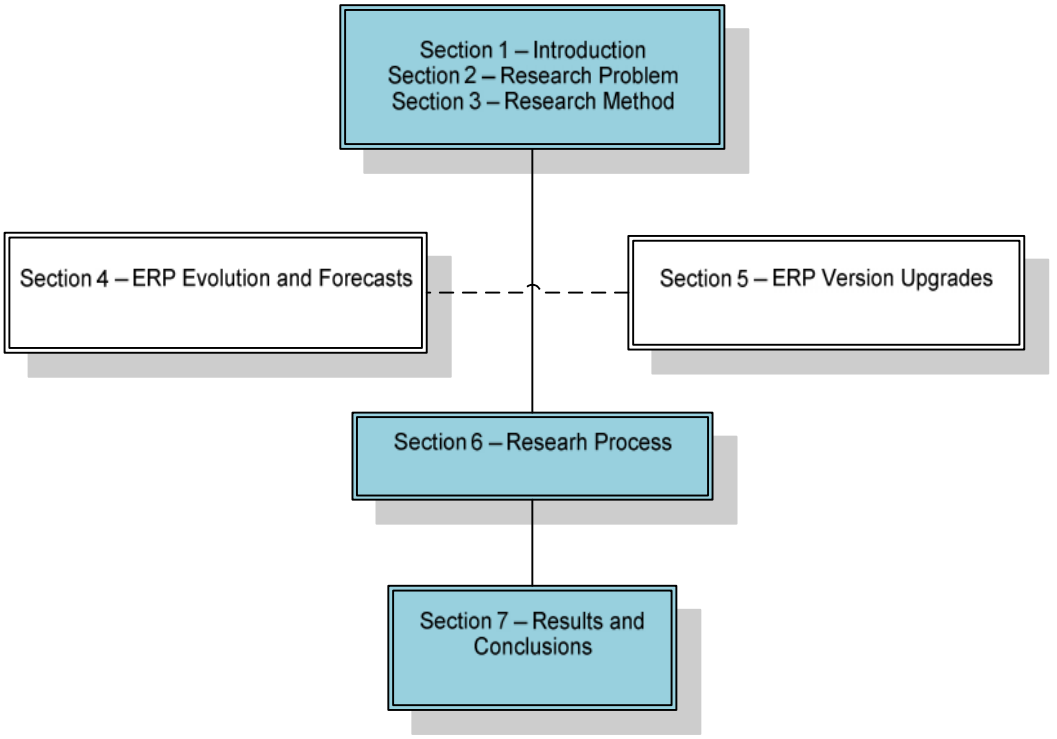


Figure 1. The Structure of the Thesis.

Section 1 gives background information concerning the concept of functionalities and TS's situation at the beginning of this study. Section 2 is devoted to the research problem solely, as section 3 to the research method. Sections 4 and 5 constitute the theoretical background of this study. In section 4 enterprise resource planning trends in the past and in the future are considered, whereas section 5 examines ERP vendors SAP, Oracle and Microsoft systems and their upgrade paths. In section 6 the research process of finding the best functionality to TS is documented, and in section 7 the best functionality to TS and other conclusions of the study are presented.

2 Research Problem

The research problem of this study is to choose the best SAP ERP 6.0 system's Enhancement Package (EHP) functionality inside the SAP HCM sector to meet the needs of TS. The HCM sector, in this case, is SAP's way to categorize its functionalities concerning mostly the business operations of Human Resources (HR). However, some of the functionalities within the HCM sector are not only for employees of the HR department. Another point is that EHPs are cumulative, which means that EHP5 will bring available, though inactive at first, all former EHP's functionalities after its installation. Since TS have none of functionalities activated yet, all EHP versions from 1-5 are valid and worth studying.

The research questions are:

- How can the selection process of interesting functionalities be developed?
- How should functionalities be classified in the future?
- What criteria should be considered before activating new functionality to an ERP system from EHPs or clouds?
- What other functionalities, besides the best one, have potential to TS now and in the future?
- What points should TS consider particularly before activating any functionality?
- How should TS roughly divide its engagement level to SAP ERP 6.0?

3 Research Method

The research problem and the research questions of the thesis were approached by qualitative methods. The total quantity of the available SAP HCM sector functionalities was examined first, and after that the quantity was reduced step by step during the meetings at TS. The interviews with TS's representative were mostly open interviews but a structured interview was also utilized, after most of the irrelevant functionalities for the TS were first eliminated.

4 The Evolution and Future of the ERP Systems

The subscriber of this thesis wanted to know how ERP systems have been evolved, and how they will most likely develop in the future. Table 1 presents what systems were utilized before the ERP, and how the ERP concept has been evolved since the term was coined. The notable point in table 1 is that the decades of Material Requirements Planning (MRP) and Manufacturing Resource Planning (MRP II) are from Mishra and Soota [2, 170] but all three decades of the ERP versions are coined by me based on the thoughts of Bill Wood [3].

Table 1. The evolution of ERP thinking divided roughly in decades. Data gathered from Mishra and Soota (2005) [2, 170] and adapted from Wood (2010) [3].

Dominating ERP thinking	**Decade**
Material Requirements Planning (MRP)	1970's
Manufacturing Resource Planning (MRP II)	1980's
Back-office ERP	1990's
ERP II (SRM)	2000's
ERP III (CRM)	2010's

In the following sub-sections 50 years of enterprise planning are presented, starting from MRP in the 1970s and ending with the predictions of the global cloud markets in the year 2020.

4.1 Material Requirements Planning

Before inventing MRP software in the 1960s there was a common way to keep track on inventories by order-point methods such as reorder-point or reorder-quantity. To work properly, previous methods usually needed large inventory levels which brought plenty of expenses. Therefore, the most urgent need to decrease the costs by MRP systems were with large manufacturing companies which had to use a large amount of various components to run their businesses. [2, 165.]

Mentzer et al. [4, 154] defines MRP as a software application of inventory control and production planning operated originally by manufacturing companies. Mishra and Soota

[2, 167] offer more detailed information of MRP software. The software calculated how much of each material or how many components were needed to produce a certain amount of end items. It also calculated when those materials and components had to go to the production, in order to get end items ready on time.

After implementation of software-based MRP, it increased agility and savings in different stages of manufacturing process by reducing finished goods inventory, as well as components and safety stocks. However, MRP systems could not update the numbers themselves when there were quick changes in the production schedule or lack of communication between suppliers and production personnel. This update problem decreased later when the closed-loop MRP was developed. It differed also from ordinary MRP, in its better control of supplier's orders and production operations. [2, 170.]

4.2 Manufacturing Resource Planning

MRP was suitable only in manufacturing operations such as factory floor because it concentrated only in components or materials. MRP II is like an extended version of closed-loop MRP because it adds more new functionality to the planning process. One of these new functionalities was simulation function which was able to answer what-if questions, whereas the other functionalities focused on integrating financial and HR operations to material requirements planning process. [2, 170.]

According to Vaman [5, 7] MRP II suffered lack of integration between its components such as manufacturing, sales and distribution. This often led to unnecessary large inventories in different stages of the supply chain. The main reason for this was technological because there was no integrated company-wide computing system available in the early 1980s. Monk and Wagner [6, 20] specify the previous statement by arguing that even sharing printers and hard disks electronically was difficult in those days. In the mid-1980s, client-server architecture made data sharing between computers easier on local networks.

4.3 Enterprise Resource Planning

According to Parthasarathy [7, 12], ERP differs from MRP II mostly in its wider scope of planning and scheduling of supplier resources, which are based on end customer's demands and schedules. Monk and Wagner [6, 19] present that there are three factors which helped ERP system to develop from MRP II. First and the most obvious is the advancement of information technology (IT). To function efficiently, ERP systems need a massive database and a company-wide network, such as the Internet, to share data between a company's departments almost in real time. It was basically not feasible until the 1990s.

The second factor was the change of managers' thinking from business functions to business processes. Business functions are different kind of routine operations practised inside a company's departments. For instance, HR is a department and its business functions are recruiting, hiring, training and firing of the employees. Business processes consist of one or more business functions and their fundamental goal is to satisfy the customer's needs as good as possible. Practically, this means that managers are able to look at their organization's operations from the customer's point of view. For example, if the company buys a product from its supplier, it affects many different departments and business functions, not just a company's purchasing organization. Because the business process model required sharing information between different departments, the ERP developers started eventually to develop integrated information systems which are the third factor of the birth of ERP. [6, 3.]

When defining of an ERP system, one word comes up more often than others: integration. Especially Koch and Wailgum [8, 1] emphasize this in their article by stating that ERP's objective is to attempt to integrate all departments and functions across an organization onto a single computer system. They also say that behind the integration of this single computer system is a common database which ensures information sharing between the systems of different departments, such as finance, HR or manufacturing, in an organization. Mishra and Soota [2, 172] summarize the fore-mentioned definition by referring to the systems as modules which are integrated to each other by ERP system. In addition, ERP systems should be like package software

whose modules have similar outlook, and are accessible without the help of the IT department, and which practically operate in real-time [9, 7].

ERP system consists of the modules of core business operations and back-office management [5, 3]. This short definition gives us a rough picture of the modules but the truth is that there is no unanimous opinion of what specific modules create the ERP system. According to Koch and Wailgum [8, 1], an ERP system is often referred to as back-office software because in the beginning it improved only the process of turning of a customer order into an invoice and ultimately revenue. This order fulfillment process does not necessarily need any direct customer contact, which is why the term back-office is still in use in this context. It is argued that calling an ERP system just a back-office system is incorrect because customers are directly involved with the operation of any today's ERP system [9, 9]. Thus, it is more reasonable to think that an ERP system is a set of uniform modules which are integrated into each other to serve a certain organization.

The main reason for why ERP systems are sometimes still incorrectly referred to as back-office software only is that ERP systems have evolved since 1990 when the concept was already envisioned by Gartner Group [10]. However, the 2010s ERP software is more complex than that in the 1990s.

Research House Gartner presented the ERP II concept and its six elements in 2000 (figure 2). The role of ERP started to change towards ERP II when enterprises began to expand their already possessed back-office ERP with new modules such as Supply Chain Management (SCM) or CRM. The new aspect here was expanded value chain of ERP system which now considered also the information of customers and suppliers. Before this ERP systems used to run an enterprise's internal processes only with mainframe computers but now these fore-mentioned modules were able to connect external resources as well. [10.]

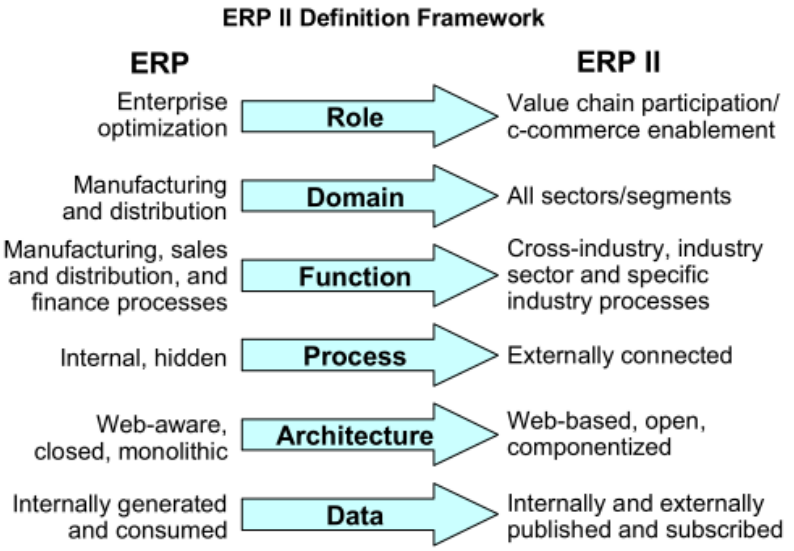


Figure 2. Six elements of the transition from ERP to ERP II. Copied from Bond et al. (2000) [10].

When ERP II systems enabled collaborative commerce (c-commerce) with business partners, suppliers and customers, it also expanded its domain from manufacturing to all business sectors. In order to work, this six-element model required the change of the architecture beneath the ERP system to support data sharing via the Internet. [10.]

The SAP Community Network blogger and consultant Bill Wood takes ERP thinking even further by presenting that there are three, not just two, different types of ERPs. He defines the traditional back-office ERP, which was popular in the 1990s, as a system of operational excellence. This means that ERP integrates business functions on premises in the one and only enterprise, and therefore focuses its value chain within the enterprise. The next type of ERP, or ERP II, was born in the 2000s when ERP vendors started to provide extended supply chain applications. As an example of these are SAP modules Supplier Relationship Management (SRM) and Advanced Planner and Optimizer (APO). [3.]

EPR II enhances operational excellence by expanding the older ERP's target area from the inside of the enterprise to the outside. Bill Wood [3] refers to this value proposition the word "innovation", which means in this instance that the enterprise can practice better collaborative innovation with its suppliers by integrating the suppliers' data to its ERP system. When the enterprise and its suppliers can communicate better, it

improves their supply chain efficiency, which brings cost savings to the enterprise. However, this does not include only better synching of the schedules between the enterprise and its suppliers or even Vendor Managed Inventory (VMI) processing but also designing together better delivery of products and services. Examples of the collective designing are online catalogs which are able to allocate customer orders to different suppliers automatically. [3.]

ERP operates inside the walls of the enterprise, whereas ERP II increases its supplier collaboration by going outside the walls also. The third type of ERP expands the collaboration to consider also customers. The customer centric value proposition does not mean the same thing as CRM because ERP III operates in direct interaction with customers in the wider marketplace, whereas CRM applications are used usually inside the enterprise to manage sales processes. ERP III is enabled by a set of rapidly evolving technology capabilities such as social media, Service-Oriented Architecture (SOA) and extended marketing analytics. An example of the latter is checkout programs from stores which are able to print advertisements on the back of receipts based on just purchased goods. [3.]

4.4 Cloud Computing

Cloud computing is definitely not a product. It is more like a concept, an industry, a marketing term or a model which has not specific definition because it is relatively new entity, and more importantly, it is still evolving and growing. This is one reason why the term cloud computing is often misused especially in the Internet marketing. Another reason is abundant terminology around cloud computing, which confuses many people.

Delivery of computing services through the Internet is probably the simplest way to define cloud computing. According to the fore-mentioned sentence, basically all computing services offered through the Internet are cloud computing. A good example is e-mail which has existed since the 1990s. This raises the question: why is cloud computing still growing and therefore changing the IT world? There are two reasons for this. Firstly, cloud computing has changed the perception of buying IT services and equipment. Not so long ago, IT used to be an investment which was acquired as a

product. However, IT investments have increasingly turned to be more like a subscription of services. The change of perception is the new point which is behind the success of cloud computing. The second reason for the success is simply that technology is developed enough to serve the new service model cost-effectively.

Cloud computing as an idea is not a new concept itself because it was already envisioned by computer scientists J.C.R Licklider and John McCarthy [11] in the 1960s. Licklider predicted that people will be able to share data with each other, and be able to access computer programs regardless their location, whereas McCarthy compared that computing power and even applications will be delivered, as if public utilities, such as electricity or water. However, it is controversial which one of these scientists would deserve the credit of envisioning the cloud concept first. [11, 1.]

It took about 40 years from envisioning the cloud, before the underlying technology and the concept itself were suitable to serve the increasing needs of the business world. Application Service Provider (ASP) model was the predecessor of Software as a Service (SaaS) model in the 1990s. Practically, the models provide the same service: hosted applications delivered over the Internet, and they are sometimes used as synonyms. However, ASP was not successful in the 1990s, whereas SaaS has been later. The main reasons were ASP's way to deliver services to customers, and the immature technology infrastructure. The model tried to meet each customer's specific needs by tailoring which led to high costs, and eventually to the end of the funding of venture capitalists in the early 2000s. [12, 1.]

SaaS dodged ASP's expensiveness problem by its multi-tenant model, which means selling or renting the same software to all customers. The drawback here is that the product is generic, which does not allow practically any customization by any customer. In other words, SaaS vendor is responsible for all updates and new functionalities of the software. The fore-mentioned multi-tenant model rules out creating a competitive edge between customers but SaaS vendors have realized the fact, and therefore concentrated mainly on business modules, such as CRM, which are seldom included in an average customer's core competencies. [12, 1.]

According to the National Institute of Standards and Technology (NIST) cloud computing has five major properties. The first one is that cloud computing must be able to be utilized on demand. A user should be able to set computing capabilities, such as server time and network storage, himself to meet the needs without contacting the cloud service provider face-to-face. The second attribute of cloud computing requires a network which is accessible by the standard operating systems, not only by desktops but also by mobile phones and laptops. [13, 2.]

The third characteristic of the NIST's cloud definition assumes that a cloud service provider uses a multi-tenant subscription model when practicing business. This also requires that the provider is able to balance its physical and virtual resources to meet multiple users' computing needs simultaneously practically all the time. Therefore, the users do not need to be concerned or even aware of how computing services are provided or where the servers in question are located. The fourth feature of the NIST's definition demands that the provider should be able to guarantee continuous service at any time, even during demand spikes by scaling computing capabilities rapidly to answer overall demand. As mentioned in the first sentence of this paragraph, cloud computing must be based on a subscription model. The fifth feature of NIST's definition complements this subscription model by assuming that charging users must be based on a metered payment structure, for instance pay-per-use. In order to work, cloud systems must also be able to monitor and report each user's resource usage to provide detailed information of the utilized services. [13, 2.]

According to NIST's cloud computing model, there are three main service models available: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). The first one is the most effortless or least configurable for an end customer because the cloud service provider is responsible for the cloud infrastructure, as well as the application itself. Customers might have been allowed to make petty configurations to their own application without altering the underlying programming code, and also to be able to access the application through a web browser. [13, 2.]

PaaS differs from SaaS in the configuration of the application. The cloud service provider is still responsible for the infrastructure platform, but now offers means to the

customer to develop and deploy applications onto it. The IaaS model takes the customer's possibilities even further than PaaS by allowing provisioning of the provider's infrastructure. This means that virtual computing resources, such as processing power or data storage, can be increased or decreased by the customer. However, the customer does not have full control of the underlying infrastructure because it is leased from the provider. [13, 2-3.]

Figure 3 compares the customer's workload in relation to the cloud service models. Customer's responsibilities and overall effort increases when moving from SaaS to PaaS or from PaaS to IaaS, or even from SaaS to IaaS. However, benefits of the previous actions might be eminent for the customer because of the software's increased customization capabilities, and consequently differentiation from the competitors' corresponding software.

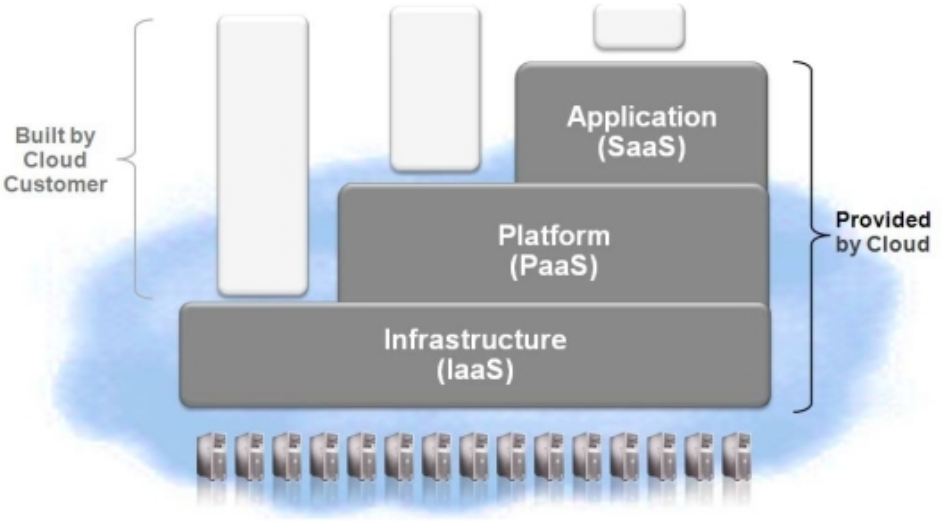


Figure 3. Customer's workload compared to different cloud service models. Copied from Piech (2009) [14, 4].

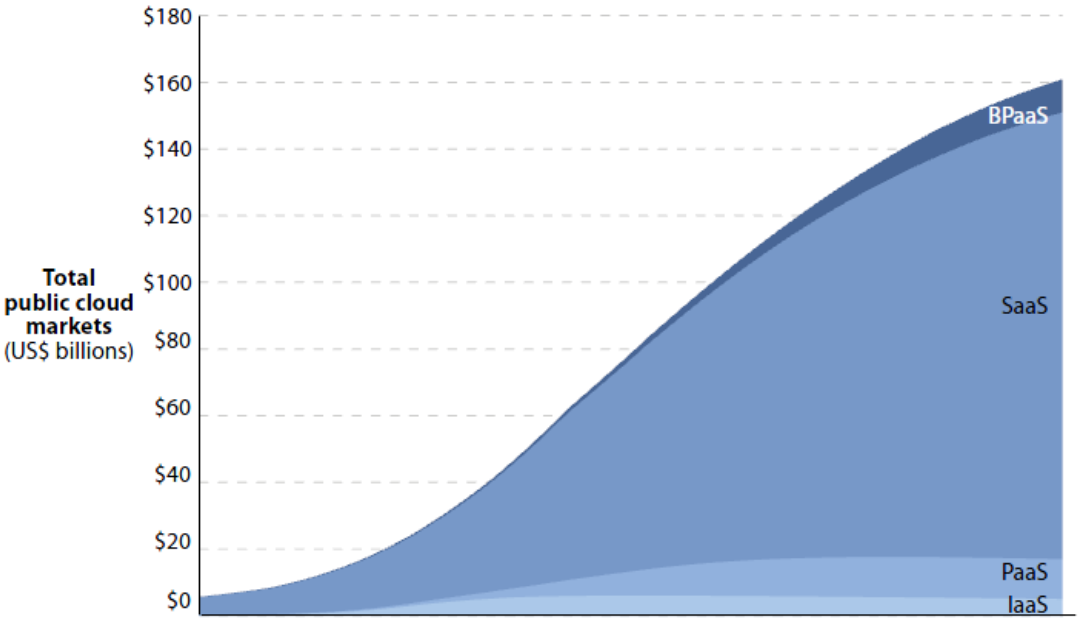
NIST defines four types of cloud deployment methods in their cloud model: private, public, hybrid and community cloud. The key difference between public and private clouds is obviously the quantity of organizations which are using the deployment option. Private clouds are carefully designed to be used by a single organization and its people, whereas public clouds are created to serve multiple organizations simultaneously. Community cloud is the case when there is more than one organization using a particularly designed cloud infrastructure. This kind of situation usually occurs

when different organizations have common concerns such as strategy, security or policy. The only clear difference when comparing a community cloud to private one is the quantity of the user organizations. A hybrid cloud bonds at least two cloud infrastructures into one, as long as the clouds still have their unique characteristics, and the data, and the applications are portable within the hybrid cloud. [13, 3.]

4.5 The Future Predictions of Cloud Computing

Cloud services, especially SaaS, have been utilized mostly by small and mid-sized companies, because a generic multi-tenant delivery model has been considered sufficient to satisfy the needs of such companies. However, in recent years also large corporations have started to implement SaaS solutions to support their businesses. For instance, General Electric (GE) made a deal with Aravo Company concerning the Supplier Information Management (SIM) SaaS product. GE has roughly 500,000 suppliers in more than 100 countries, whereas Aravo is quite a small and unknown SaaS vendor. [15, 1.]

Figure 4 presentes the total public cloud markets growth with four different delivery models of cloud services. The SaaS model holds currently the lion share of the markets and it should keep the head start in the future with ease, when comparing to the others. However, the relative growth of delivery models measured by percentages sets the SaaS model only to the third place, even if the market should almost 10-fold between 2010 and 2020. The reason for this is that both Business Process as a Service (BPaaS) and PaaS markets were so tiny in 2010 that they have more potential or space to grow from around 0.3 billion dollars to over 10 billion with the same time period than SaaS does. On the other hand, the IaaS market should keep growing to the year 2014, and after that start slowly declining.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BPaaS ($)	0.15	0.23	0.35	0.53	0.80	1.26	1.95	2.93	4.28	6.00	7.66	9.08	10.02
SaaS ($)	5.56	8.09	13.40	21.21	33.09	47.22	63.19	78.43	92.75	105.49	116.39	125.52	132.57
PaaS ($)	0.05	0.12	0.31	0.82	2.08	4.38	7.39	9.80	11.26	11.94	12.15	12.10	11.91
IaaS ($)	0.06	0.24	1.02	2.94	4.99	5.75	5.89	5.82	5.65	5.45	5.23	5.01	4.78

Figure 4. The predicted global public cloud markets growth by Forrester Research, Inc. Copied from Dignan (2011) [16].

A notable feature of the overall cloud markets growth is that the vast majority of the growth should be concentrated on the public cloud markets with a 27% compound annual growth rate (CAGR), whereas private cloud markets should grow more steadily 8% CAGR (figure 5). Public and private clouds refer to the deployment methods, which were explained on page 14 of this thesis.

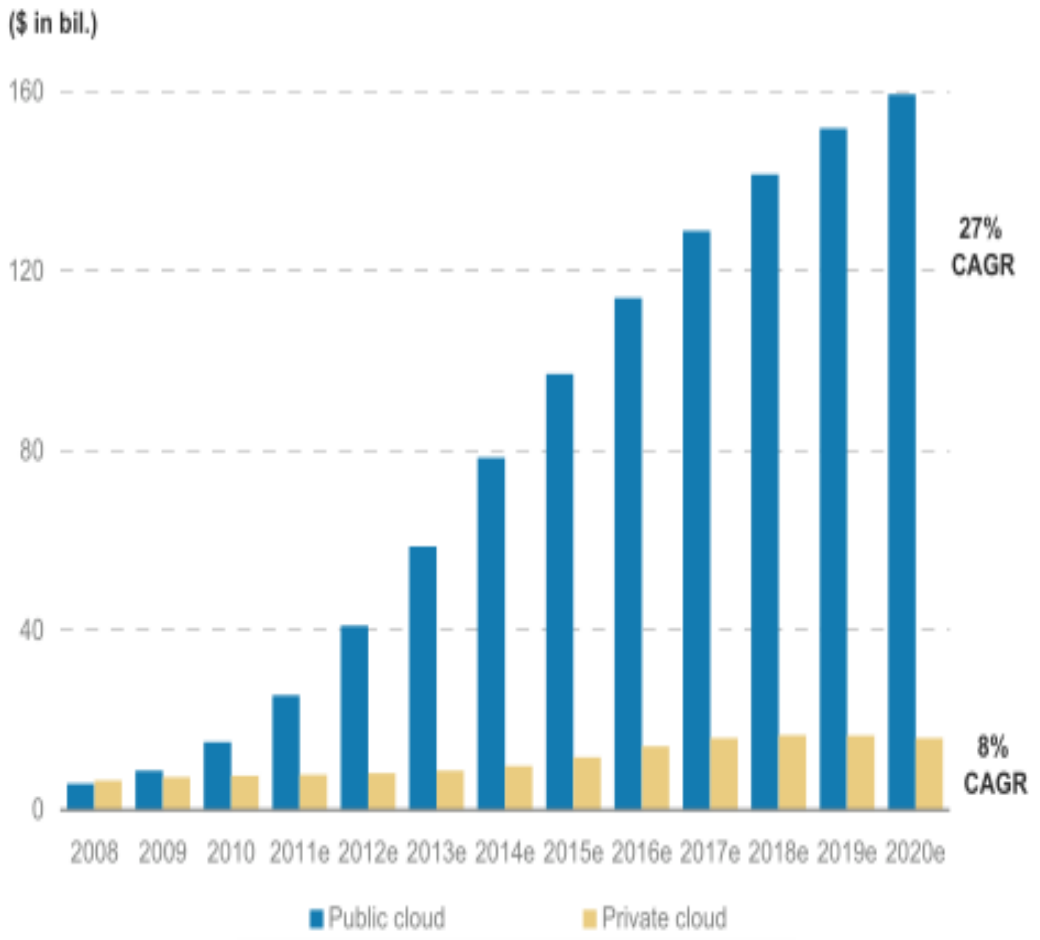


Figure 5. The predicted total revenues growth by Forrester Research, Inc. between public and private cloud (SaaS/PaaS/IaaS) segments. Copied from Cloud Computing Takes Off (2011) [17, 55].

Forrester Research, Inc. is not by any means the only research house which is predicting huge growth for cloud markets. In fact, it is very hard to find any convincing evidence from the Internet that the global cloud markets would not grow in the future. Instead, an another research house, International Data Corporation (IDC), predicts that the spending on public IT cloud services will increase from $21.5 billion in 2010 to $72.9 billion in 2015 with 27,6% CAGR [18]. Thus, the growth seems to be similar with Forrester Research predictions in the public cloud sector (figure 5), even though the companies utilize their own parameters in their predictions.

Needless to say, the third research house, Gartner, Inc., forecasts also fair growth for the worldwide cloud services revenue from $58.6 billion in 2009 to 148.8 billion in 2014 [19]. Gartner also publishes information of cloud markets concerning exclusively the

ERP sector in their press releases. For example, the proportion of the overall SaaS revenue from the whole ERP revenue was about 7% in 2011. In the same year the HCM sector was one of the most affected by SaaS adoptions, whereas manufacturing and enterprise asset management were being relatively unaffected by SaaS [20].

As Gartner was able to provide information about SaaS and its impact on the HCM sector, Morgan Stanley Research goes even deeper in its report (appendix 1). In the report the HCM sector is divided into four segments: Performance management, E-recruiting, E-learning and Other SaaS HCM. The SaaS revenue from each sector was measured in 2010 and predicted to 2015. Also leading and emerging beneficiaries are named as ticker symbols, which are usually abbreviations from the names of the companies which are listed on the stock markets. All SaaS segments within the HCM sector are predicted to grow in the future. [17.]

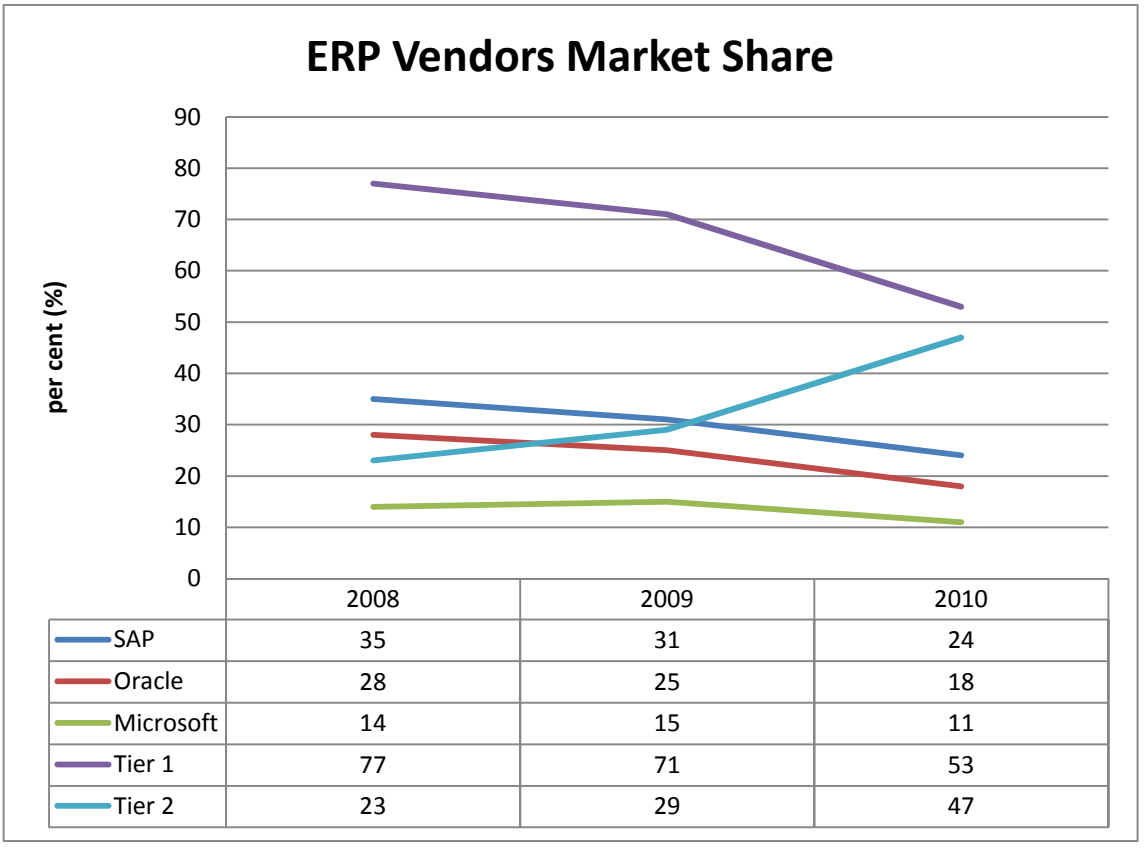
As overall cloud offerings are growing, it will give some serious alternatives to TS besides the SAP EHPs when activating new functionalities in the future. A good example of this is TS's already rented Performance management SaaS solution from SuccessFactors Company, which was acquired later by SAP AG. SAP provides also Performance management functionality within its EHPs but the decision-makers at TS concluded that the SuccessFactors' SaaS alternative was a more relevant choice to them in this case.

5 The Largest ERP Vendors and Their Innovation Cultures

TS also uses many other ERP systems in its operations than SAP ERP 6.0. The subscriber of this thesis wanted to know how the largest ERP vendors used to upgrade their ERP versions. This chapter presents the intervals of the major ERP version upgrades from ERP vendors SAP, Oracle and Microsoft. The major ERP version here is considered to be the one which is suited to large enterprises, if possible. Also the main cloud product from each of the vendors is presented briefly because cloud computing is an emerging trend in the future, concerning the whole IT market.

5.1 The Market Share Between ERP Vendors

Figure 6 describes the market shares between leading ERP vendors and smaller competitors in the years 2008-2010. All five curves and digits below the chart present percentages of the total market share (100%). Tier 1 represents, in this case, the combined market shares of SAP, Oracle and Microsoft, whereas tier 2 represents the combined market shares of all other known ERP vendors.



	2008	2009	2010
SAP	35	31	24
Oracle	28	25	18
Microsoft	14	15	11
Tier 1	77	71	53
Tier 2	23	29	47

Figure 6. The market share between Tier 1 and Tier 2. Data gathered from 2008 ERP Report, Part II: Comparing Leading Tier I and Tier II ERP Solutions (2009) [21, 1], 2010 ERP report: ERP Vendor Analysis (2010) [22, 2], 2011 Guide to ERP Systems and Vendors (2011) [23, 2].

Even though tier 2 has more than doubled its market share between 2008 and 2010, there is no doubt that the top three ERP vendors are still SAP, Oracle and Microsoft when measured by market share (figure 6). However, the decreasing trend of tier 1 in the previous years indicates that tier 2 might overtake it during the year 2011 or 2012. The main reason for this kind of development, tier 2 growth, of the market shares is probably the increased usage of cloud services within the ERP market. Especially many small and midsized companies have been implementing cloud ERP systems, since they are considered faster to deploy and easier to maintain than traditional on-premise ERP systems.

5.2 Innovation Culture Between ERP Market Leaders

Table 2 presents the major ERP system upgrades from Oracle, Microsoft and SAP between the years 2000-2011. The first issue shown in each box, beneath the ERP version box, presents the version name of the upgrade, and inside the brackets, if possible, is the month of the release year.

Table 2. The collection of ERP systems release versions from Oracle EBS, Microsoft AX and SAP ERP in years 2000-2011. Data gathered from Oracle Information-Driven Support (2010) [24, 6-7], Chan (2009) [25], Chan (2009) [26], Chan (2010) [27], Kanaracus (2011) [28], From Axapta 1.0 to Microsoft Dynamics AX 2009 (2012) [29], Shave (2011) [30], SAP Release Strategy for Large Enterprises (2011) [31, 50], Jakowski (2003) [32, 29]

Year	**Oracle EBS Versions (release month)**	**Microsoft AX Versions (release month)**	**SAP ERP Versions (release month)**
2000	11.5.1 (May) 11.5.2 (October)	Axapta 2.1 (January) Axapta 2.5 (December)	SAP R/3 Release 4.6C
2001	11.5.3 (January) 11.5.4 (June) 11.5.5 (September)		
2002	11.5.6 (January) 11.5.7 (May) 11.5.8 (November)		SAP R/3 Enterprise Release 4.70
2003	11.5.9 (June)	Axapta 3.0 (October)	mySAP ERP 2003
2004	11.5.10 (November)		mySAP ERP 2004/ECC 5.0
2005			SAP ERP 6.0/ECC 6.0 (October)
2006		Dynamics AX 4.0 (March)	SAP EHP 1 (December)
2007	12 (January)		SAP EHP 2 (July) SAP EHP 3 (December)
2008		Dynamics AX 2009 (June)	SAP EHP 4 (November)
2009	12.1.1 (May) 12.1.2 (December)		
2010	12.1.3 (August)		SAP EHP 5 (December)
2011	Fusion Applications (October)	Dynamics AX 2012 (September)	

There are two notable points in table 2. The first is that Microsoft Dynamics AX ERP family has not been upgraded as often as SAP's or Oracle's has. This kind of development can be explained by the relatively smaller enterprise size of Microsoft ERP customers. In general, the smaller the company, the smaller needs when considering ERP upgrading. Microsoft has plenty of small and mid-size enterprise customers, and in fact, not one of its ERP products is segmented only to large enterprise customers. The second notable point is that SAP's latest large ERP version upgrade is from 2005, whereas Microsoft and Oracle managed to upgrade their major ERP version in autumn 2011. However, since 2006 SAP has been providing new functionality to its SAP ERP

6.0 via EHPs in relatively fast pace. The sixth EHP was entered to the ramp-up phase in November 2011 [33].

5.2.1 SAP ERP 6.0 and Enhancement Packages

SAP AG uses repetitively in its marketing the term “solution” when speaking of ERP systems. These solutions or ERP product families can practically handle all business needs from companies of any size or any industry. For small businesses, less than 100 employees, SAP provides SAP Business One Application, and for midsized companies, up to 2,500 employees, is recommended SAP Business All-in-One solutions [34, 3]. However, to get transparency to the TS case, it is more relevant just to concentrate on SAP ERP 6.0, also known as ECC 6.0, and also SAP Business ByDesing, which is SAP’s current cloud solution.

SAP ERP 6.0 is a part of the integrated enterprise applications delivered within the SAP Business Suite software. Other applications within the software are SAP Customer Relationship Management, SAP Product Lifecycle Management, SAP Supply Chain Management and SAP Supplier Relationship Management. [35.] SAP ERP instead consists of three solutions: SAP ERP Financials, SAP ERP Human Capital Management and SAP ERP Operations [36].

Between 2002 and 2005, SAP launched a new ERP version every year (table 2). The latest SAP ERP in 2011 is still version 6.0, which was launched in 2005. Since then SAP has launched EHPs roughly once a year in order to reduce the implementation effort when compared to full version upgrades. This also gives a choice for the customer to jump over EHPs as they like, which gives them flexibility.

Before the EHP concept SAP AG used to update its system via version upgrades. Practically this meant that the operating SAP ERP system sustained similar in many companies for several years without any major innovations. The reason behind this was often a heavy implementation effort of the version upgrade on the behalf of the user. If the user wanted to upgrade the SAP system for a particular business purpose, the only way to do that was to build the needed new functionality manually by coding it to the system’s codebase. However, this way was often hard and expensive to carry

out. SAP EHPs were created to substitute heavy version upgrades by adding new functionalities onto the existing SAP ERP 6.0 system platform more regularly than before (figure 7).

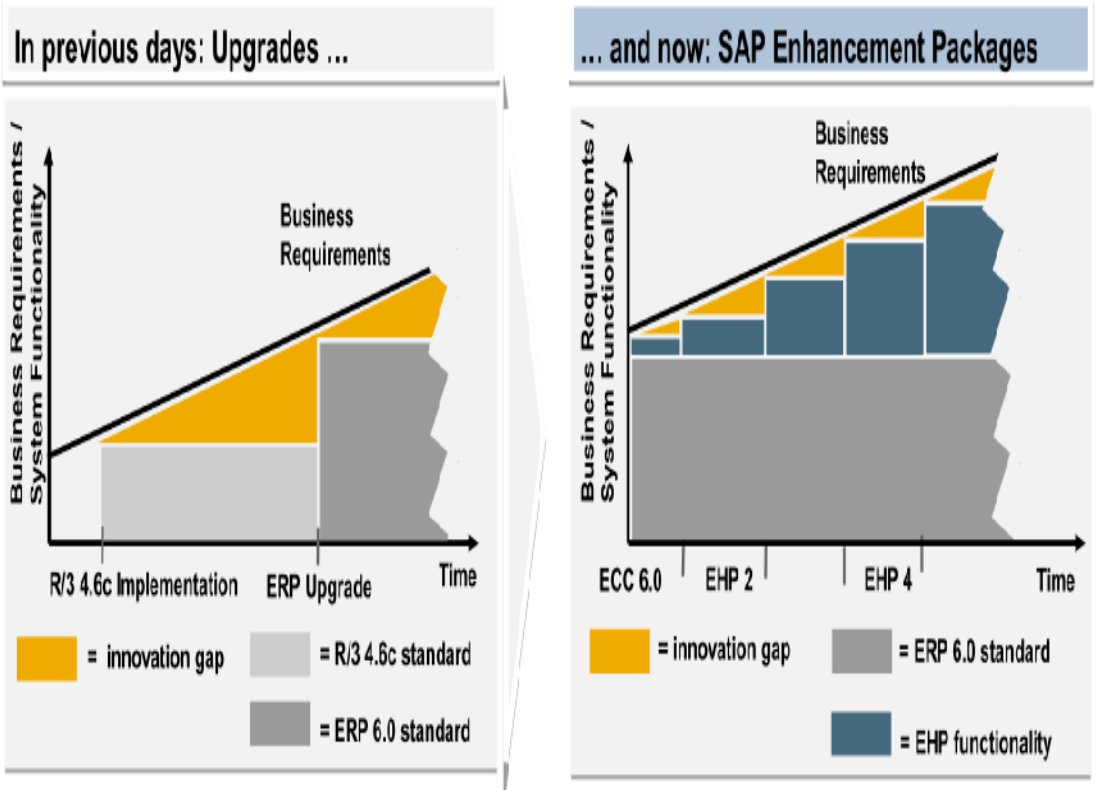


Figure 7. SAP EHPs shortening the innovation gap. Copied from SAP enhancement packages for SAP ERP: Technology Facts [37, 7].

The notable point of EHPs is the user's variety. This means that the user may choose which new functionalities are desired to the SAP system and which are not. There are around 600 functionalities all in all available, so it is important to eliminate unnecessary functionalities before installation of any EHP package to clarify and speed up the implementing process. However, after installation of the latest EHP and pre-chosen functionalities, it does not matter if there are futile functionalities among them because they do not have any effect on the system at this point. All functionalities are inactive as a default after installation. Therefore, functionalities need to be activated separately in order to have effect on SAP system. [38, 8.]

SAP Business ByDesing is SAP Corporation's cloud solution. It is specifically targeted at small and midsized companies, who want to run their businesses without investing in

heavy IT infrastructure and spending money on the ramp-up costs. However, the solution is able to manage the most common business modules of any company such as Financials, CRM, Projects, Procurement, and SCM. The customers can choose any modules they wish without the necessity to take the irrelevant modules with the whole set. [39, 7.]

5.2.2 Oracle E-Business Suite and Fusion Applications

Oracle Corporation provides its customers with many different ERP systems and other supportive applications around these. The reason for this is that in previous years the company has acquired several smaller software firms such as PeopleSoft, which have their own ERP suite. Oracle has been selling its purchased smaller ERP vendor's products separately in their own applications families. However, it is more relevant to concentrate on Oracle's ERP system, E-Business Suite (EBS), which is a popular choice among large enterprises, than observe every single Oracle's ERP application separately. Firstly, this limitation simplifies comparison between different ERPs in tier 1 (figure 6), and secondly EBS is going to be supplemented eventually by a new ERP product, Oracle Fusion Applications. [34, 2.]

EBS consists of different product families such as financials, procurement and CRM. Each product family consists of individual applications which are licensed separately. This means that the user company can choose only those product families for a fee which are suitable for the company's business and ignore all irrelevant product families and their applications. [40.]

Table 2 shows most of the notable EBS releases and their generally available dates since the 2000s. Release versions are updated by "packs", and the third number of a particular release version indicates which pack is in the case. Some of these update packs deliver both new functionalities and enhancements to existing EBS product families, whereas some packs just focus on bug fixes. [27; 41.] The latest EBS version 12.1.3 was released in August 2010 [27]. The next EBS version will be most likely 12.2, which was not yet released in early February 2012 [42].

Fusion Applications was published generally available at Oracle's OpenWorld conference in October 5, 2011. It took more than six years to develop Fusion Applications ERP suite from the best features of Oracle's existing ERP solutions, such as EBS, PeopleSoft, JD Edwards and Siebel. [28.]

Oracle's customers must not need to upgrade their existing Oracle ERP to the Fusion Applications immediately or make a large and expensive version upgrade anytime soon. This is possible because Oracle will support and develop its older ERPs for many coming years. Another even more remarkable point is that Fusion Applications can operate at the same time as the already existing ERP does. The ERP systems coexisting capability enables moving to the Fusion family at the rate of speed which should be suitable to the most of the Oracle's ERP customers. For instance, if the customer can identify a business need which cannot be satisfied with the existing ERP, the customer can implement just one module from Fusion Applications to satisfy the business need by a new functionality. In other words, the customer company can basically decide when to move to the Fusion Applications and to what extent. [43, 1]

Fusion Applications provides versatile deployment options such as on premises, public clouds, private clouds or even hybrid combination of the clouds. This is possible because of the accurately designed foundation of the Fusion Middleware which supports Service-Oriented Architecture (SOA), and utilizes the same codebase. [44.] This means basically that the customer can choose, not just when but also how to deploy Fusion Applications most efficiently.

5.2.3 Microsoft Dynamics AX and Azure Platform

Microsoft Corporation develops and supports its ERP product families under the name "Dynamics" with its large partner network. Figure 8 presents four of Microsoft's ERP products: AX 2009, NAV 5.0, GP 10 and SL 7, and their placement on the ERP market by their target customers' revenue [45, 7]. This study is about upgrading of ERP systems of large companies, and that is why it is most relevant to focus on only at the AX ERP product. Even though the AX is suited for large enterprises more than any other ERP solution of Microsoft Dynamics family, it is still mostly targeted at the companies of the upper midmarket.

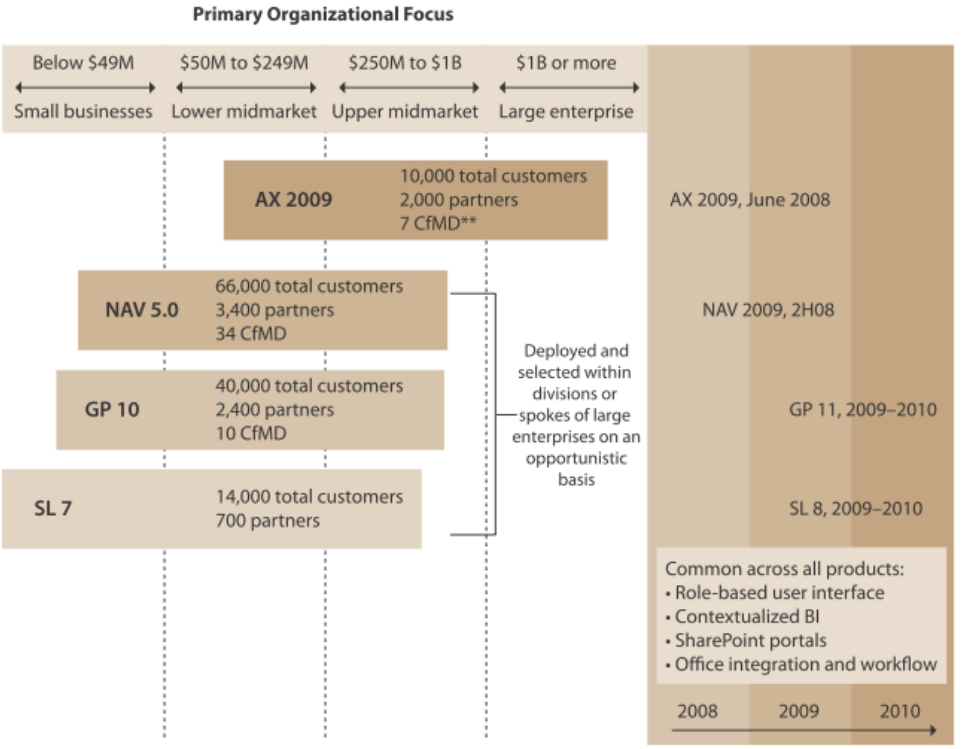


Figure 8. Microsoft Dynamics ERP products organizational focus. Copied from Jacobson & Prescott (2008) [45, 7].

AX was formerly known as Axapta (table 2). The reason for this is that Microsoft acquired it from the recently merged Danish company named Navision-Damgaard in 2002. In July 2006, Microsoft changed the Axapta name to Microsoft Dynamics AX. [29.]

Microsoft Corporation launched its latest ERP version, Microsoft Dynamics AX 2012, on top of the version AX 2009, in September 8, 2011. The successor version can basically handle the same business needs in multiple industries as SAP ERP 6.0 or Oracle's EBS does. [30.] However, Microsoft differs from the other two ERP vendors in its way of developing the AX product family by offering it to the independent software vendors (ISVs) as a platform, where they can build industry-specific solutions on their own [46].

So far, Microsoft has been selling its Dynamics ERP products on-premises through its partners which have hosted the applications in their own data centers. This is about to change because Microsoft have been announced that it will move all of its Dynamics

ERP products into the cloud. More precisely, Microsoft will move its ERPs to its Azure cloud platform in stages. For customers, this will mean that there is no longer need to install the ERP software in their computers, whereas partners will no longer host customers' applications. [46; 47.]

The customer companies of Microsoft can build, host and scale some of the applications with the Azure, while the master data is stored in Microsoft's data center. Therefore, the Azure can be categorized as a PaaS service model. [48.]

6 Search for the Best SAP Functionality to TeliaSonera

This chapter concentrates on solving the actual research problem which is finding the best SAP functionality inside the HCM sector for the business needs of TS. The TS own project team's process of finding and testing new functionalities is documented in section 6.1. The SAP Business Function Prediction (BFP) and its significance are discussed in section 6.2. The interviewing process of this study is described in section 6.3, and based on these interviews the actual business cases of top-5 functionalities for TS are created in section 6.4.

6.1 The Research Process of the External Project Team

TS had a project team consisting mostly of external consultants who started to seek potential HCM functionalities in autumn 2011, regardless of this thesis. However, this study will at least ensure that all necessary functionalities were found by the project team, and if not, this research will bring up functionalities once ignored which have also much business potential now or in the coming years.

Figure 9 presents the team's planned schedule starting from autumn 2011. First of all, the notable point is to realize the different parties and their roles. Process and IT Alignment (PITA) means, in this instance, TS's internal customers who are TS's decision-makers concerning HR operations in the Nordic countries. ES represents TS's IT operations unit whose job is to develop the IT systems of TS's internal customers, and in this case find new SAP EHP functionalities inside the HCM sector for PITA's SAP ERP 6.0 system.

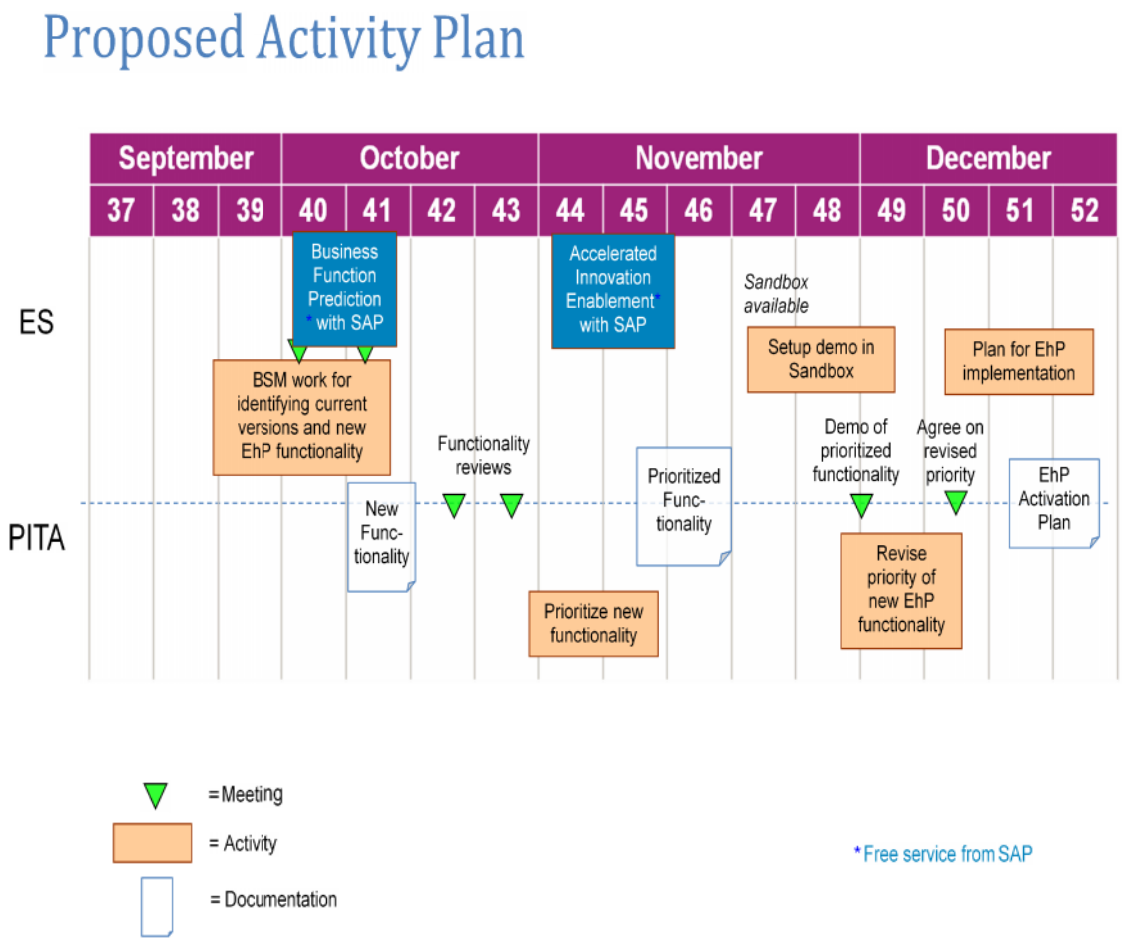


Figure 9. Project team's proposed schedule. Modified from HCM EhPx – New Functionality Analysis & Planning (2011) [49, 2].

According to the Proposed Activity Plan (figure 9), Business Service Manager (BSM) started to examine what EHP functionalities SAP AG has to offer inside the HCM sector in week 39 in 2011. The main source of information here was basically SAP Service Marketplace, which is accessible through the Internet and is restricted to SAP customers only by passwords. The BFP analysis was received in week 42, and after that the team started to eliminate unnecessary functionalities. By then, their project had proceeded in the same way as my study.

The project team utilized SAP's Accelerated Innovation Enablement service which is focused on SAP customers who are planning the deployment of EHP. The service is delivered remotely by SAP software architects, who will help to deploy EHP to the SAP system in the way which will meet the business process requirements of the customer. In order to get help, the customer at first needs to deliver the documentation from the relevant company's core business process and the system landscape to SAP AG. [50, 26.]

The project team built a demo in their sandbox from each of their chosen potential functionalities to clarify the obtained enhancements from new functionalities to the PITA team. Sandbox is a company's IT system test environment which is utilized when there is a need to configure the business processes of the production system. The production system is the company's actual system which runs its business processes, whereas the test system or test environment is the virtual place, mimicking the actual system, where to configure, demonstrate or test the system's capabilities without tampering the production system, and consequently risking its functioning. [51.]

The project team presented its "Benefit and Cost Analysis of EHP" within the HCM sector in January 23, 2012 [52]. The source material here [52; 53] are considered classified. The project team scored six different functionalities, whose versions are combined in this case, based on the benefits of Finland's, Sweden's and Denmark's internal customers [53]:

- HCM, Enterprise Compensation Management 01 & 02
- Travel Management 1-3
- HCM, Reconciliation Localization for NO, SE and FI
- Employee Self Services on Web Dynpro ABAP
- HCM, Administrative Services 01-03
- HCM, PD UI Visualization 01

6.2 SAP Business Function Prediction

SAP offers Business Function Prediction (BFP) service for free to its customers. The idea of BFP is to separate the most relevant functionalities from others, and therefore

help in decision making. In order to utilize BFP, the customer needs to create a list of the SAP transaction codes which the company usually uses in its business. The transaction codes are like hotkeys such as “miro”, “mir6” or “va03” which are used in the SAP system to move quickly from one business landscape to another. There are two ways to collect the transactions. The first method is using the SAP workload monitor which creates the list of transactions automatically, and the second way of making the list is to collect the transaction codes manually. After that, the customer needs to contact SAP personnel via email and send the transaction list with some additional info to them. SAP will analyze the transaction list and send back email, where the most suitable functionalities are ranked by relevance percentage based on the given transactions and the actual SAP system usage.

The project team utilized the BFP analysis to strengthen their grasp of pre-chosen functionalities. The transaction codes of SAP were collected automatically by the SAP workload monitor from the used transactions in the HR department at TS. Table 3 shows the results of BFP analysis within HCM sector, which were obtained in October 20, 2011, and its suggested functionalities in order of their relevance to the HR department of TS.

Table 3. The results of BFP analysis within the HCM sector.

Functionality (EHP version)	Relevance (%)	Popularity Ranking (0-5)
HCM Localization Topics (EHP3)	100	2.5
HCM, Localization Enhancements for NPO (EHP5)	97	N/A
HCM Localization Topics for Norway (EHP4)	94	1.5
HCM, Personnel Actions for Concurrent Employment (EHP4)	92	2.5
HCM, Learning Solution 01 (EHP2)	89	3.5
HCM, Enterprise Compensation Management 01 (EHP4)	87	4.5
HCM, Rehiring Following Retirement Topics for Japan (EHP5)	85	N/A
HCM, Enterprise Compensation Management 02 (EHP5)	83	N/A
HCM, Hire Integration 1 (EHP5)	81	N/A
HCM, Enterprise Services 01 (EHP2)	77	2.5
TNM/LSO Integration (EHP4)	77	2.5
Travel Management (EHP2)	75	4.5
Travel Management 2 (EHP4)	71	4.5
Travel Management 3 (EHP5)	71	N/A
HCM, MSS for SAP E-Recruiting (EHP3)	70	3.5

The BFP gave a total of 26 functionalities within the HCM sector but the relevance percent was set here to be at least 70% due to accuracy (table 3). The relevance of 100 percent means that the functionality should be a perfect match to the organization, whereas 0 means that the functionality should be as irrelevant as it can be to the organization. The functionalities also got the popularity ranking given by the existing SAP customers. The popularity ranking might be helpful when considering activation of lesser obvious functionalities. The ”N/A” means that the data was not available, because EHP5 was the newest version during the time of the TS BFP results were obtained. When popularity is ranked to 0, it is considered the least popular, whereas rank 5 means the most popular.

6.3 The Research Process of the Study

Figure 10 describes what the study is all about: eliminating the unnecessary functionalities to find the best functionality for TS. The research process is like building a pyramid. The bottom floor is the starting point where approximately 600 known functionalities exist at the time of this study. The upper floor is where HCM functionalities are separated from other functionalities. Still, there are much functionalities left at this floor, the second lowest, but the number was reduced to 56 by separating the not updated functionalities (appendix 2) from the updated ones. The floor of "TOP-26" functionalities was built by the results of open interviews with a TS anonymous representative and TS Chief Architect, Mika Karvinen. These top-26 functionalities are listed in appendix 3 where only the newest versions, or not updated ones, from each of the functionality are taken into consideration.

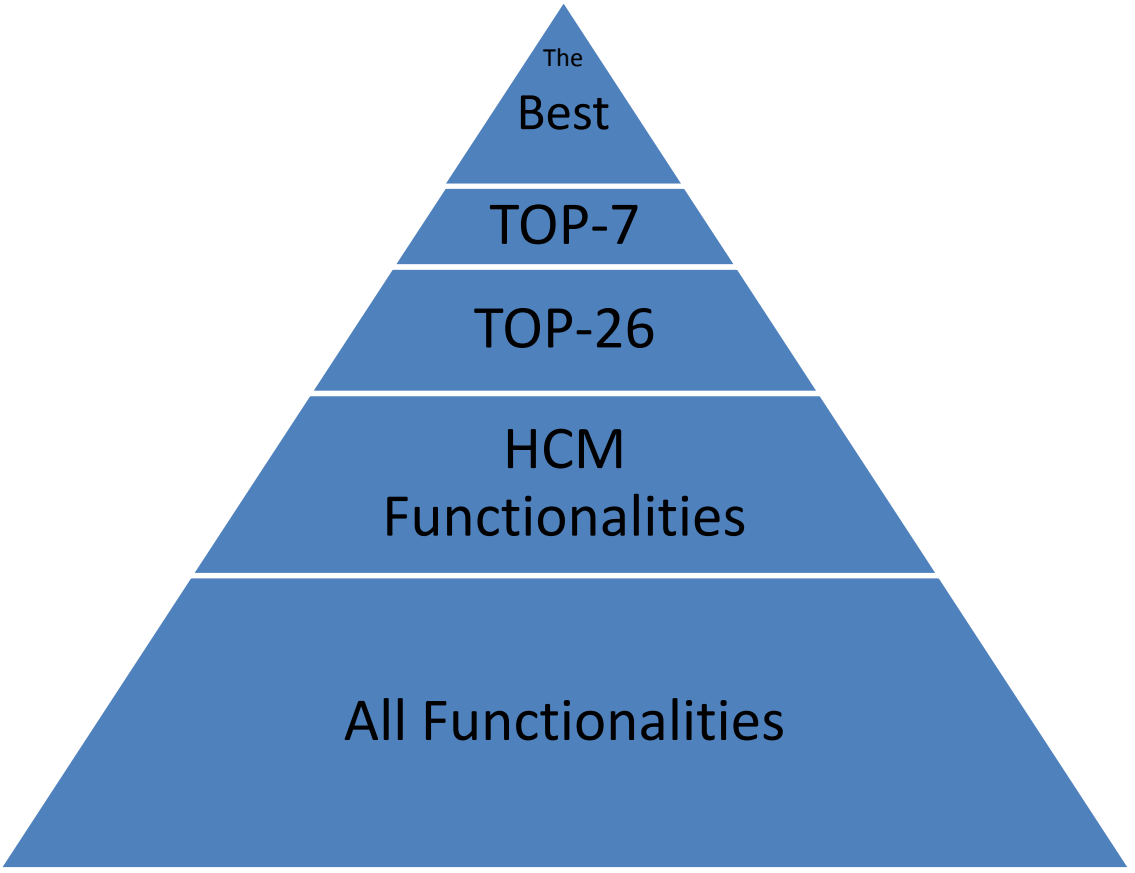


Figure 10. Discrimination process of functionalities described from down to up.

The second upmost floor (figure 10) of the pyramid was created by scoring these potential functionalities based on 4 factors which were obtained from the structured

interview questions (appendix 4). Only 7 functionalities were scored because the rest of them were irrelevant, mostly because the back-end SAP system was not in use at TS in the case of these functionalities. Exceptions here are functionality versions 02 and 03 from the Administrative Services business function which was scored to demonstrate the significance of the usage of the back-end system at TS and abandoned, due to its low scores. Another business function, "HCM, ESS for Personal Information", was disqualified also, due to its low benefits to TS. Finally, the top floor was built after creating the business cases from top-5 functionalities.

The roadmap of functionalities (figure 11) was formed during the interviews. It estimates when Learning Group, SAP E-Recruiting Group and other individual functionalities are going to be current to the TS. Even if functionalities which are not topical for TS were disqualified in this research now, it is still important to roughly recognize the timeframe when they might have potential for TS next time.

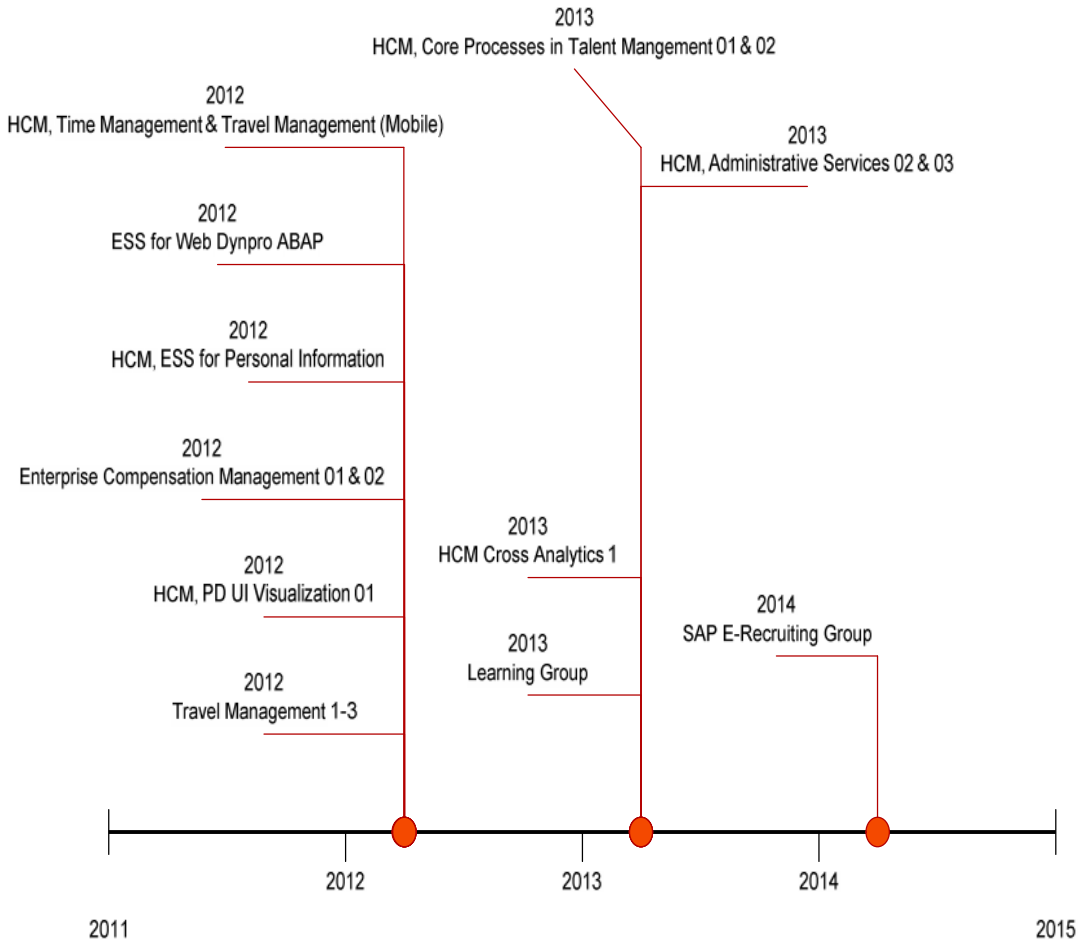


Figure 11. TS roadmap of functionalities.

The functionality groups were built during interviews because each group contains functionalities which have strong integration between each other (figure 12). Therefore, it is unreasonable to activate only one business function from any group or even estimate its individual potential to TS without considering also the others. The functionality group Concurrent Employment is not presented in the roadmap (figure 11) because TS has no plans for it in the next coming years.

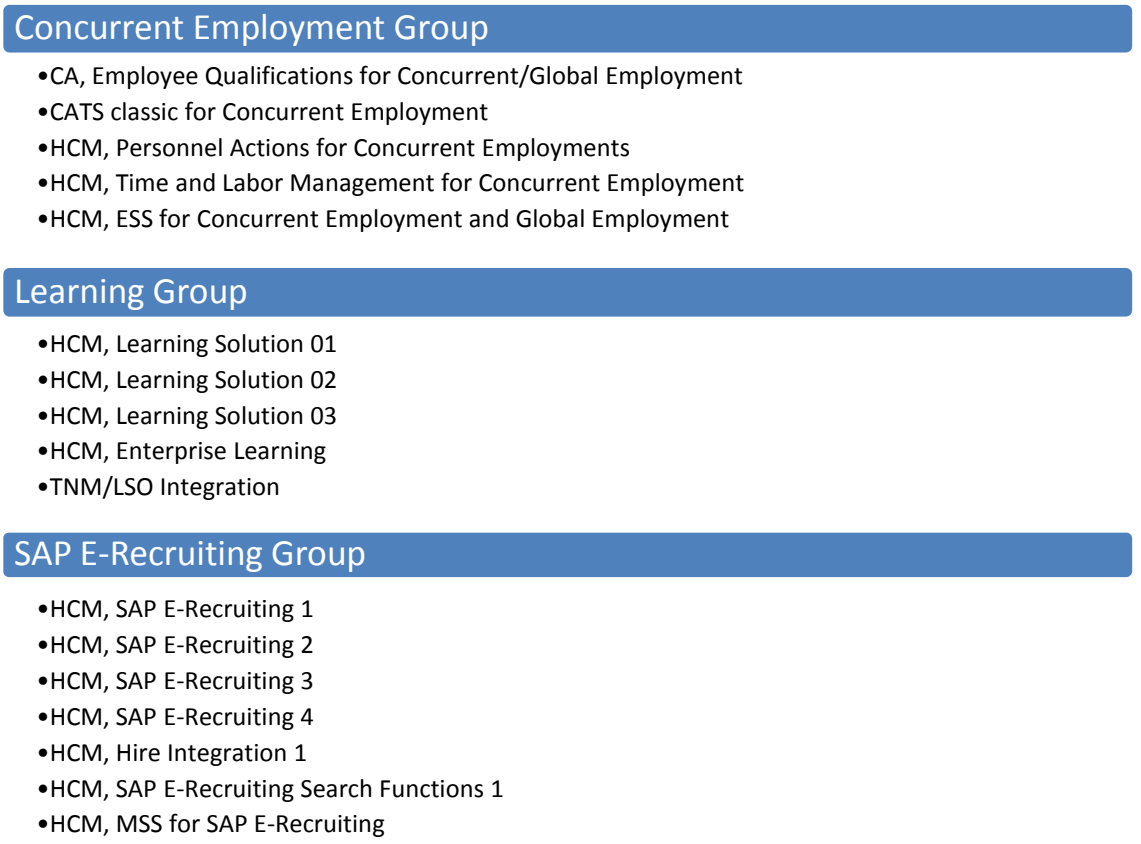


Figure 12. Content of the functionality groups.

Table 4 summarizes the results from the structured interviews (appendix 4). Only 7 functionalities were scored due to the irrelevancy of the rest. Still, the total score difference between the worst and the best functionality was even 42 points. The absolute maximum total scores of the structured interviews were 124 points because in question 3 (appendix 4) bonus points were given as a total of 24 points from daily usage of HR key users, other HR personnel and supervisors.

Table 4. Results from the interviews of TOP-7 functionalities.

Functionality	**Q1**	**Q2**	**Q3**	**Q4**	**Total Score**
HCM, Time Management & Travel Management (Mobile)	50	15	16	2	83
HCM, Administrative Services 02 & 03	25	10	22	2	59
HCM, ESS for Personal Information	50	20	7	5	82
HCM, PD UI Visualization 01	50	20	17	5	92
Travel Management 1-3	50	20	18	4	92
HCM, Enterprise Compensation Management 01 & 02	50	20	15	4	89
Employee Self Services on Web Dynpro ABAP	50	20	28	3	101

The functionality “HCM, ESS for Personal Information” (table 4) was not taken among the top-5 because any of its three features did not answer to the current needs of TS sufficiently well, even if the business function managed to score 82 points. Its first feature “Enable employees to maintain foreign address data in ESS” was considered to be suitable only for “a handful” of TS employees living near the strait between Sweden and Denmark. This mainly explains its lowest scores from question 3 (appendix 4). The second feature “Customizing enhancement for Personal Information Overview screen” from the functionality was unnecessary because the current personal information editing possibilities in the SAP system Employee Self-Services (ESS) was considered sufficient. The third feature from the same functionality “Enhancement of ESS Personal information screens for US and Germany” was simply not relevant for TS because the company has not enough operation in these countries.

Another disqualified functionality from the top-5 was HCM, Administrative Services versions 02 and 03, due to its low scores (table 4). The first version of the functionality was not taken into consideration because of its irrelevancy to TS. At any rate, it is important to recognize that the business function was the only one in the top-7 whose back-end was not in use in the SAP system of TS already. Because the purpose of new functionalities is to enhance the already existing business processes of the back-end system, there is no point to activate any functionality before the back-end system runs the corresponding software component. That is why there was a huge 25-point difference between answers in question 1 (appendix 4). However, the functionality has much potential in the future, but only if TS decides to implement the corresponding back-end in use within the SAP system.

Figure 13 presents relative matching of the most interesting functionalities, whose versions are combined, from the choice of the different parties. The pink circle of the project team consists of the 6 functionalities presented in sub-section 6.1. The blue circle, or the larger one, consists of the 7 functionalities presented in table 4. Likewise the beige circle of the BFP, or the largest one, is based on 15 functionalities presented in table 3.

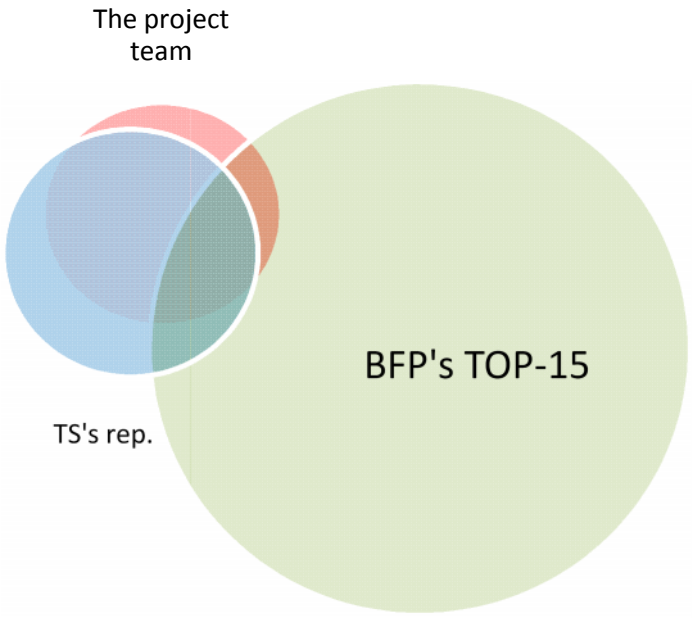


Figure 13. Relative matching of choices from different parties.

After comparing the results of the different parties (figure 13), it seems that the project team was able to find one business function, “HCM, Reconciliation Localization for NO, SE and FI” outside the other circles, whereas TS’s representative found two functionalities “HCM, Time Management & Travel Management (Mobile)” and ”HCM, ESS for Personal Information” outside the other circles. Surprisingly, the BFP analysis was able to find only two functionalities “HCM, Enterprise Compensation Management 01 & 02” and “Travel Management 1-3” from both of the other parties’ circles.

6.4 Business Cases of TOP-5 Functionalities for TS

SAP AG divides its EHP functionalities into smaller sub-parts called features in their published material. The quantity of features varies between functionalities, and some

features are completely new at the time when they are released, and others just improve existing features. In the case of TS, all relevant functionalities and features are new and worth studying because TS's HR organization has not activated any functionality yet. During the open interviews of this study TS's representative separated relevant features from irrelevant ones, and after that compared each business function to the corresponding business process of TS. The selection process of features is demonstrated in figure 14 where red-colored feature boxes are considered as rejected ones and green-colored as accepted ones.

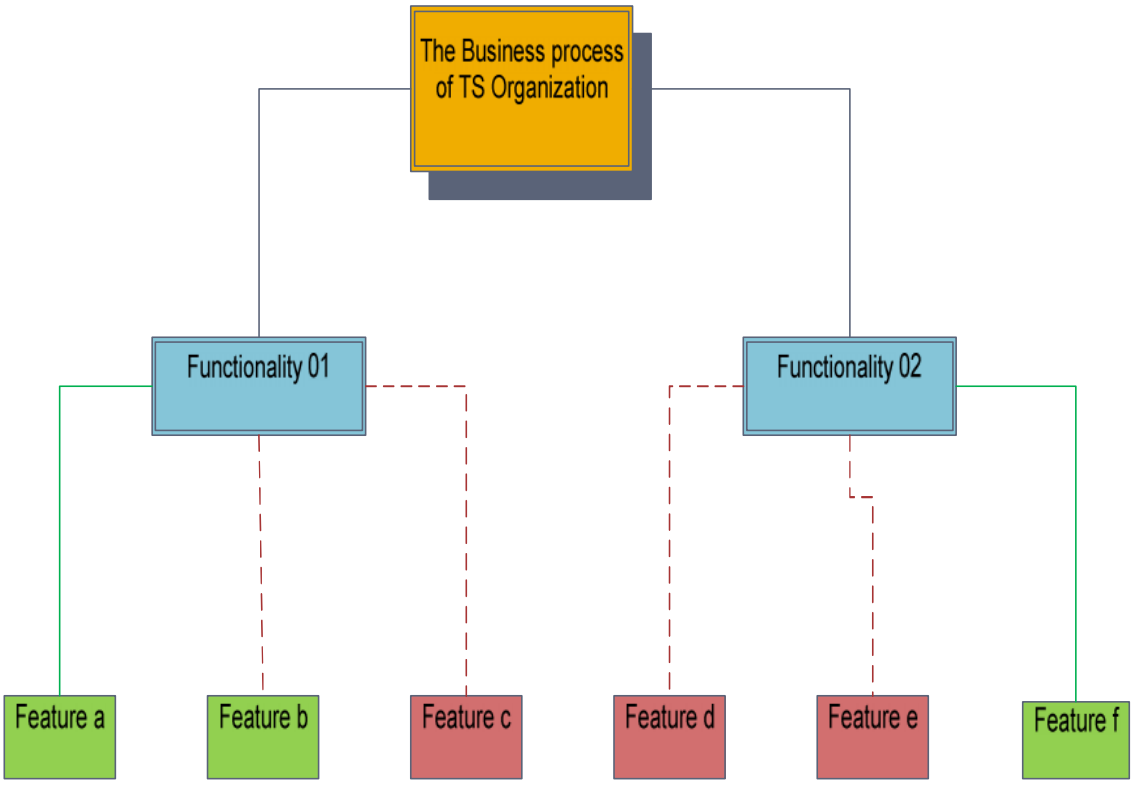


Figure 14. The process of recognizing the relevant and irrelevant features from each functionality.

Figure 15 presents the relative implementation effort of functionalities estimated by TS's representative. The relative features of the TOP-5 functionalities are taken into consideration only.

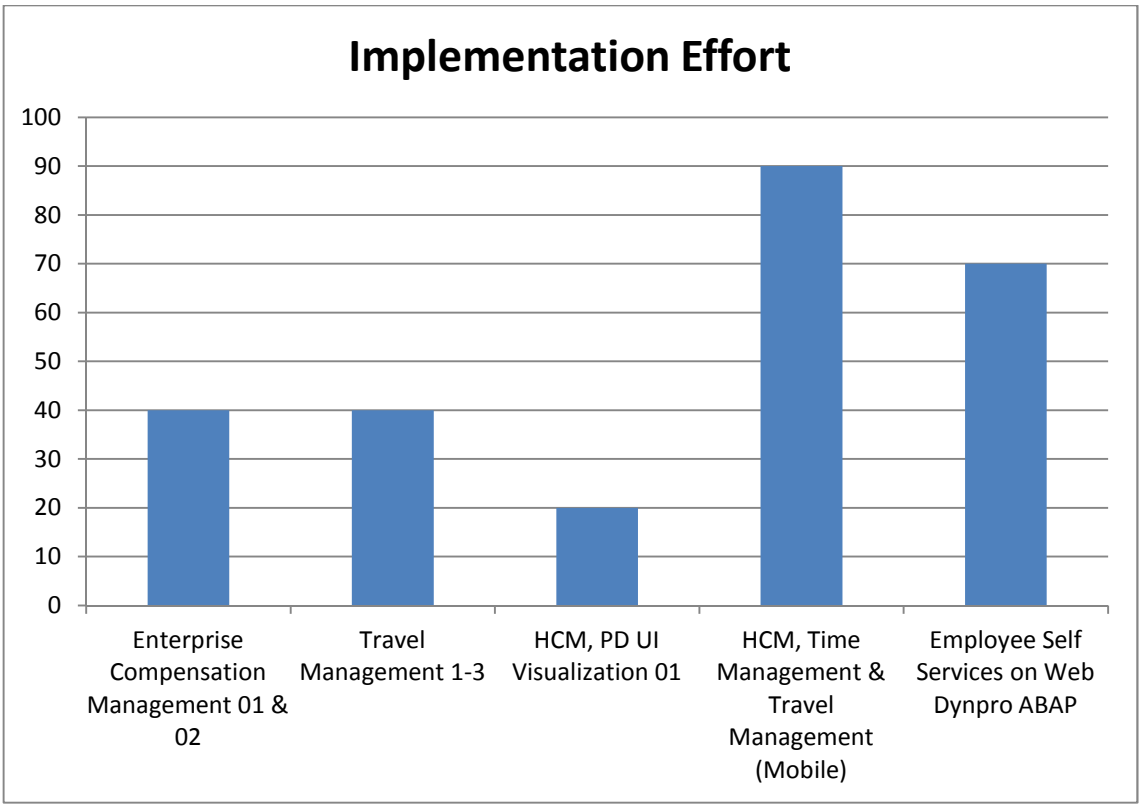


Figure 15. The relative implementation effort of functionalities estimated by TS's representative.

The effort is scored from 0 to 100 meaning that the higher the score, the more effort is needed to activate the functionality to TS's SAP production environment. The effort includes, in this case, calendar time and workload by implementation consultants and also the other investments needed (figure 15).

6.4.1 Employee Self-Services on Web Dynpro ABAP

This functionality consists of two features, "Improved UI and Navigation" and "Enriched functionality" [54, 126-127]. Both of the features are relevant to TS, and because they are relatively similar, it makes more sense to examine this functionality as an entity than separate these features and examine them individually.

The SAP ESS is a suite of applications which used to be delivered to end-users through SAP NetWeaver Portal only. In the portal employees can maintain and change their personal data, and therefore reduce the burden of the HR staff. The ESS is integrated with a front-end and back-end system. The former is the SAP NetWeaver Portal which

provides user interface (UI) to the front end-users, and it can be accessed through the Internet browser, whereas the latter is the place where HR master data exists. [55.]

With the functionality ESS on Web Dynpro ABAP, the ESS can be used in SAP NetWeaver Portal roles just like so far (figure 16). However, if there is a need to use ESS without the portal, then the Business Package Employee Self-Service (WDA) 1.50 is required as a prerequisite, in order to use ESS in the SAP NetWeaver Business Client (NWBC) for the HTML role [56].

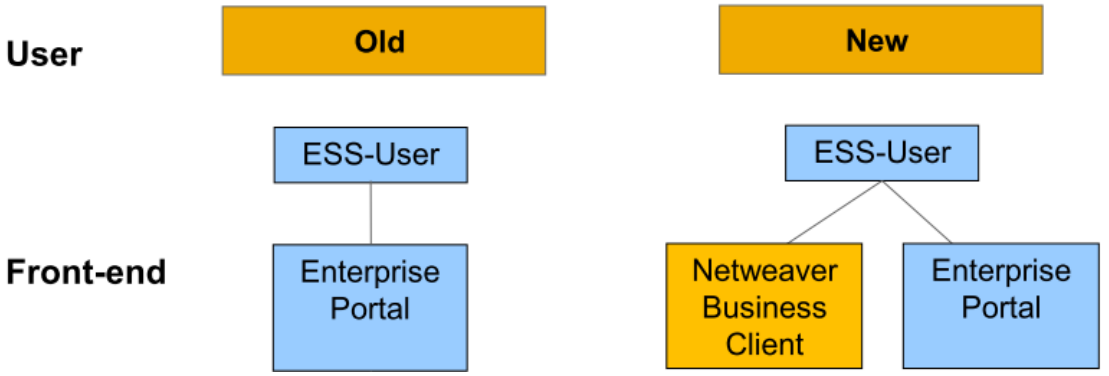


Figure 16. The deployment options for front-end users. Data modified from What's new in ESS SAP Enhancement Package 5 for SAP ERP (2008) [57, 4].

The main purpose of ESS on the Web Dynpro ABAP business function is to convert the ESS from Java-based technology to Web Dynpro ABAP-based technology, which should improve the UI by making it more eyes-appealing and easier to navigate, and therefore increase user satisfaction. Another benefit from leaving the Java parts off the ESS should be reduced total cost of ownership (TCO) which should start to generate after there is no longer a need to maintain unnecessary Java stack. [58.]

ESS on Web Dynpro ABAP brings new services, with Employee Self-Service (WDA) 1.50 component, to many other business functions such as "HCM, Administrative services 03", "Travel Management 3", "HCM, Core Processes in Talent Management 02" and "HCM, SAP E-Recruiting 4", only if these functionalities are activated. In order to use these functionalities with an ABAP-based new UI, the functionality ESS on Web Dynpro ABAP must be also activated. Future EHPs will provide new functionalities and features in ABAP-based ESS only. [56.]

According to the project team's data from EhP New Functionality List Business Benefits [53], the largest benefits clearly lie within time management from the functionality ESS on Web Dynpro ABAP. The internal customers of TS from Sweden, Finland and Denmark were considered to get benefits from this functionality, which not only got the highest scores of their evaluated six functionalities, but also was the only one benefiting all internal customers in every three countries at the same time.

The time management function from ESS on Web Dynpro ABAP simplifies, and therefore expedites, employees' time administration processes in ESS, such as creating leave requests or recording working times with Cross-Application Time Sheet (CATS). In the same way it should simplify the manager's processes in Manager Self-Service (MSS) concerning approval of leave requests and time sheets. [58.]

Although TS should get most of its immediate benefits from ESS on Web Dynpro ABAP, the functionality also serves as an investment of future. SAP AG will develop new functionalities based on Web Dynpro ABAP technology only, at least what comes to ESS. Since thousands of TS employees utilize ESS in their daily operations, even small enhancements and updates in the UI or functioning of ESS can accumulate, due to a large group of TS's ESS users, to great benefits among the employees. The overall benefits might not realize just as a time savings, but also in increased user satisfaction.

Another point when pondering the expected value of ESS on Web Dynpro ABAP is its multiple integration points to other functionalities. The business function includes services from other functionalities, and most of these were mentioned in the TS's roadmap of functionalities (figure 11). Thus, if TS decides to activate some of the functionalities from the roadmap in the next coming years, it would increase utilization and probably benefits of ESS on Web Dynpro ABAP.

During this study, SAP presented already the sixth version of its EHP concept, and a group of its new HCM sector functionalities [59, 12]. Among these is the ESS on Web Dynpro ABAP 2, which is a successor of the first version, and it is the only functionality which gets updated among the TOP-5 functionalities presented on this study, for now in the early 2012. It is a positive sign that SAP develops ESS on Web Dynpro ABAP

because it gives a choice to the customer to activate it immediately or later when the time is right.

Regardless of the immediate and potential future benefits of ESS on Web Dynpro ABAP, it has also some disadvantages. The first one is a relatively high implementation effort compared to the other TOP-5 functionalities (figure 15). On the other hand, this is understandable in this case because the functionality provides a broad set of enhancements and new services with the new ABAP-based UI to many other business functions. The second disadvantage is quite a low utilization rate of the functionality for TS at present. If TS will not activate any functionality from the roadmap (figure 11) in the future, then the benefits of this business function will stay small and the payback time will be long.

6.4.2 HCM, PD UI Visualization 01

The functionality PD UI Visualization 01 consists of two features which both are relevant to TS. The feature “Embedded organizational charts in Manager Self Services (MSS)” is designed only for employees who have access to the MSS tool [60, 3]. The SAP MSS tool is suited only for different types of higher officials such as heads of departments, line managers, team leaders and project managers. An individual manager’s area of responsibility is limited by SAP system’s authorizations. [61.] With this fore-mentioned feature, the user can view graphical charts from the chosen organization. When knowing the hierarchical relationships of the organization, the user can find the right people faster from the organization and with this business function edit the details of the work position, such as title, description or qualification requirements more easily. [60, 3.]

Another feature within the functionality is called “Technical interfaces for position management by external partner solution ‘STVN’”. This feature is suitable for employees who need to select, change, clone or create positions within their organization without a deep knowledge of SAP system [60, 2.] The abbreviation “STVN” means SAP Talent Visualization by Nakisa. Nakisa is a corporation which develops fully integrated organization visualization software to the SAP ERP HCM back-end. [62.]

At present, the SAP system of TS is able to form charts with an old fashioned look depending on the user's authorizations in the SAP system. If the manager's authorizations do not allow finding a certain employee from the other organization, then there is a way to find it by using the search function from TS's Intranet. However, the fore-mentioned way gives a list of names but does not clearly show the hierarchical relationships between the employees. With PD UI Visualization 01 managers cannot only visualize their possibly multi-level organizational structures more easily, but also zoom in and out of these structures. Another enhancement is a search function for employee names, locations and titles, which should help to find a certain person from the charts more quickly. [63.]

According to TS's representative, TS is interested in both features from the business function at the moment but there is still a chance that some SaaS company might provide a better organizational charts solution for TS. However, the implementation effort of PD UI Visualization 01 is considered the lowest of TOP-5 (figure 15), which supports this functionality as a strong alternative to the corresponding SaaS alternatives.

6.4.3 HCM, Time Management & Travel Management (Mobile)

The functionality Time Management and Travel Management (Mobile) consists of three features which are all relevant to TS. It enables users to send their working hours, travel requests and leave requests via mobile devices such as smartphones and tablet computers to their back-end SAP system [53, 200]. Even if travelling employees who are used to spend much time off their workstations probably find this most useful, the functionality can also increase overall amount of punctual inputted working times among all SAP users. When a company can transfer their recorded working hours to the payroll personnel on time, they can calculate salaries faster, and the employees of the company can be paid on more accurately. Another point to note is that, if an employee simply forgets to input working hours at the workplace, he or she might input wrong data later more likely, due to the longer time interval off the user's computer.

TS's representative envisioned that TS might decrease its employees' dependency of laptops by increasing mobile devices usage within the company in the next coming years. This supports two statements from TS's corporate strategy, which are focusing on strong growth in mobile data and migration to Internet Protocol based services, in the intensively competitive Nordic and Baltic markets [64].

The business function "HCM, Time Management & Travel Management (Mobile)" which fits TS's strategy, might give some brand value to TS indirectly by the grapevine phenomenon. This would be seen, for instance, every time when TS's employee says to somebody that he or she is able to make travel requests, leave requests or record working hours with a smartphone and send the data to the back-end SAP system. As TS has thousands of SAP users in several countries, the rumor, or brand value in this case, would spread within time.

The functionality Time Management and Travel Management (Mobile) would also decrease dependency of laptops. Nowadays TS's employee needs to carry a work laptop everywhere he or she goes and make sure that it has power in it and a secure Internet connection available, in order to use it, for example mark down recorded working times in SAP system's CATS. With this business function the laptop's role would change to correspond more like a stationary desktop personal computer which stays at the workplace all times, whereas a mobile device would be sufficient in most of the business trips.

Even though this functionality would increase employees' flexibility, lead to faster communication, and maybe give some serious brand value, these benefits would come with a high price. According to TS's representative, this functionality has the highest implementation effort from top-5 functionalities (figure 15). Because potential brand value, at this case, is very challenging to estimate, there is quite a large risk included in this business function.

6.4.4 Travel Management 1

There are three Travel Management functionalities which have 24 features altogether. However, there is only one relevant feature to TS located in Travel Management 1,

called “Improvements Expense Report”, which enables attaching documents such as receipts or agenda to an expense report [65, 3]. In order to get these paper attachments in electrical form, a traveler must first scan the papers, but after that transferring, searching and archiving of the data is much faster and more efficient than dealing with paper documents.

The current post-travelling process in TS requires handling and archiving of paper receipts. After a business trip, the traveler’s manager checks and approves the traveler’s made expense report in the SAP system, whereas the traveler posts the receipts attached to the printed expense report to the person, who is responsible for archiving the travel documents. Surprisingly, the previous process does not necessarily become more efficient with the new feature because scanning of receipts takes some time when compared to sending them in an envelope with the expense report to the archive via in-house mail. However, most of the benefits come after the traveler sends the receipts to the next person who handles the archive.

Keeping the physical archive organized is necessary, in order to find a certain receipt relatively swiftly but it takes much time, and keeping up the storage room ties up some capital. Maintaining the electric repository of receipts in the SAP system would remove these inefficiencies, and even searching for and accessing the right receipts from there is faster than from a perfectly organized storage room of physical receipts. Thus, the feature would make the archiving process more efficient by eliminating physical archives in several countries. The electronic archive would store all travel documents in the SAP system, and therefore need some extra servers and maintenance, but it would be still cheaper than a physical archive in a long run.

The electronic archive does not have a high priority, and it is relatively insignificant because when the receipts are in the storage room, it is very rare that there is a need to search for some receipts from there. Practically the only cases are some tax inspections about once in 5 years. Another issue against this functionality is also that activating this individual feature practically requires activation of Travel Management functionality versions 2 and 3 as well. The reason for this is that if the feature would be implemented solely, it would cause inconsistencies in user interface screens between TS’s travel applications. The benefits from the features from Travel

Management functionality versions 2 and 3 were considered low by TS's representative. Thus, there is a large negative side included in the feature "Improvements Expense Report" from the functionality version 01 (figure 15).

6.4.5 HCM, Enterprise Compensation Management 01 & 02

The first version of the functionality "HCM, Enterprise Compensation Management 01" was released within EHP4 and the second version within EHP5. Both of these functionality versions contain relevant features for TS. The first version has two relevant features called "Enhanced planning and approval functionality" and "Additional HR reporting capabilities". The third feature in it, "Enhanced HR administration functionality", was rejected during interviews. The second version has, as well, two relevant features for TS but also two irrelevant ones. The relevant features in this case are called "Compensation planning and planning overview user interfaces" and "Compensation profile". [66, 2; 67, 2.]

With the feature "Enhanced Planning and Approval Functionality" from version 01 higher-level managers can accept, reject or change the compensation planning data made from all of their subordinates. This so-called Multilevel Approval Process should simplify and expedite the compensation planning process because it does not require approval from subordinate managers (figure 17). For instance, if one subordinate manager is on sick leave, it does not delay the compensation planning process anymore, and if a higher-level manager is absent, another higher-level manager can make the decision. After accepting or rejecting the compensation document, higher-level managers can rationalize their thoughts to it briefly by leaving a notification, and thus communicate with their subordinates more easily. [68.]

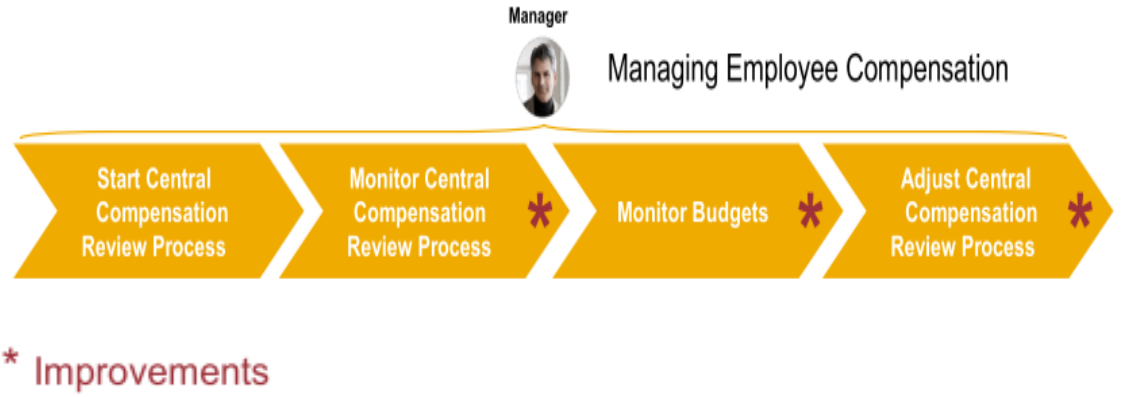


Figure 17. The process of the feature "Enhanced Planning and Approval Functionality". Copied from HCM, Enterprise Compensation Management 01 (2008) [66, 3].

The second interesting feature from TS's perspective from version 01 is "Additional HR reporting capabilities". This feature mostly enhances existing HR's compensation reports by emphasizing the compensation planning cycle and monitoring capabilities of it [68].

According to TS's representative, TS has customized its own approval logic to its SAP system considering compensation planning years before the feature "Enhanced Planning and Approval Functionality" from version 01 was launched within EHP4. If TS would decide to implement the functionalities 01 and 02, the old customized approval logic would be substituted by the relevant features from version 01. The positive aspect in this case would be that TS would not need to develop the existing approval logic anymore because the developing would be SAP's responsibility now. The negative side would be that the already invested money in the approval logic would no longer generate benefits to TS.

The feature "Compensation planning and planning overview user interfaces" from Enterprise Compensation Management 02 provides a new UI to managers, thanks to Web Dynpro ABAP technology, considering compensation planning processes [54, 182]. The feature also increases overall flexibility with small enhancements and improves communication between compensation administrators and managers with its power user tool [67, 4].

The “Compensation profile” feature from version 02 increases transparency of employees’ profiles by viewing their compensation histories, organization details and talent profiles. Especially when comparing employees’ short profiles side by side, managers can get an insight into employees’ compensation adjustments more easily than before. [67, 5]

Both “HCM, Enterprise Compensation Management” functionality versions strive to enhance compensation sub-processes such as planning, monitoring and approval. However, it is hard to estimate if these functionalities should be implement at TS because only the feature “compensation profile” related enhancements were estimated to generate medium benefits to TS in Finland and Sweden. The rest of the features scored mostly low scores. [53.]

7 Results and Conclusions

The goal of this study was to find out the best SAP ERP system functionality to TS within the HCM sector functionalities. Table 4 TOP-7 functionalities are scored based on the structured research questions (appendix 4) answered by the TS's representative. All of these functionalities have some potential when considering the needs of TS, but in reality there is no clear winner which would be the axiomatic choice for every situation. The reasons for this are multiple integration points between functionalities, unnecessary features of functionalities, and predicting both time and money savings between different functionalities after implementation.

During this study I tried to predict time savings of every TOP-7 functionalities (table 4) but the idea was abandoned quite soon because the benefits of the functionalities were seldom tied up to time savings directly. Instead, most of the benefits from the business functions were usually received from a few enhancements for a particular business process of TS. This leads to the second challenge of this study, which are unnecessary features and enhancements of functionalities. Only two functionalities "HCM, PD UI Visualization 01" and "HCM, Time Management & Travel Management (Mobile)" from TOP-5 contained relevant features only to TS.

The third challenge, multiple integration points of functionalities, is the most conclusive. At the beginning of this study, the general thought was that activating functionalities would be a simple task. However, my perception changed after the irrelevant functionalities for TS had been eliminated, and I started to examine the relevant features from the remaining functionalities. It seems that SAP AG has designed functionalities as a way that practically encumbers from activating just a few random functionalities, but instead locks in a customer after it has implemented a few critical functionalities. The engagement occurs gradually when activating functionalities, due to many prerequisites and integration points between functionalities. For instance, when a customer wants to activate a certain new functionality, it is quite rare that there are not any other requirements such as prerequisite functionalities or integration points to the other functionalities, or any irrelevant features included with the desired functionality. The engagement is not

necessarily a negative matter, if a company decides to stick tightly within SAP ERP 6.0, but in the case of TS, it is the most conclusive one.

Before activating any larger implementation-needed functionality, in my opinion, TS should create a verbal or written policy which dictates the commitment degree towards EHP activations. This method would help to perceive the point where TS has a certain clearance to activate new relevant functionalities without the commitment to the other irrelevant functionalities.

The level of commitment can be divided roughly into two levels. The first level would be a committed way of activating new functionalities which would increase TS's dependency of the SAP system. In addition, implementing new functionalities among one department would very likely support the other functionalities as well. The second level would be an alternative way of activating new functionalities, which means that EHPs would be considered as an alternative to the software developed by other companies. The commitment level towards EHP functionalities in this case would be kept minimal, in order to activate new functionalities from the other software vendors as well, if needed.

The Best SAP ERP 6.0 System Functionality to TS within the HCM Sector

The functionality "HCM, ESS on Web Dynpro ABAP" from EHP5 is the best choice for TS to be implemented during 2012. The main reason for this is that it has not serious weaknesses when compared to the other top functionalities. It also provides more immediate benefits to TS within its Time Management features than any other functionality, and it works as a future investment for TS since SAP AG will most likely increase the development of ABAP-based functionalities in the future. It scored highest both in the project team's analysis [53] and TS's representative (table 4). Last but not least, it is the engagement policy independent functionality which does not engage TS, if the company decides to implement this business function but still want to keep the clearance for the other alternatives outside the SAP system.

References

1 TeliaSonera in brief [online]. TeliaSonera Plc.
URL: http://www.teliasonera.com/en/investors/telia-sonera-i-brief/. Accessed 18 December 2011.

2 Mishra, R., C., Soota Tarun. Modern Project Management. New Delhi, India: New Age International, Ltd; 2005.

3 Wood, Bill. ERP vs. ERP2 vs. ERP3 Future Enterprise Applications [online]. R3now Consulting, LLC; 31 May 2010.
URL: http://www.r3now.com/
erp-vs-erp-ii-vs-erp-iii-future-enterprise-applications. Accessed 16 January 2012.

4 Mentzer, John T., Myers, Matthew B., Stank, Theodore P. Handbook of Global Supply Chain Management. California: Sage Publications, Inc; 2007.

5 Vaman, Jagan Nathan. ERP in Practice: ERP Strategies for steering organizational competence and competitive advantage. New Delhi: Tata McGraw-Hill Publishing Company Limited; 2008.

6 Monk, Ellen F., Wagner Bret J. Concepts in Enterprise Resource Planning. 3rd ed. Boston: Course Technology Cengage Learning; 2008.

7 Parthasarathy, S. Enterprise Resource Planning: A Managerial and Technical Perspective. 1st ed. New Delhi, India: New Age International, Ltd.; 2007.

8 Koch, Christopher, Wailgum, Thomas. ERP Definition and Solutions [online]. CXO Media, Inc; 17 April 2008.
URL: http://www.cio.com/article/40323/
ERP_Definition_and_Solutions?page=1&taxonomyId=3009. Accessed 12 January 2012.

9 Manufacturing Moving Towards a Collaborative Supply Chain [online]. 9 September 2010.
URL: http://theprofessornotes.com/wp-content/uploads/2010/09/
Manufacturing-moving-towards-a-collaborative-supply-chain_wiki.pdf. Accessed 16 January 2012.

10 Bond, B., Genovese, Y., Miklovic, D., Wood, N., Zrimsek, B. and Rayner, N. ERP Is Dead – Long Live ERP II [online]. Gartner Group, Inc; 4 October 2000.
URL: http://www.sunlike.com.cn/internet/ONLINEERP/images/
Long%20live%20ERPII%20By%20Gartner%20Group.pdf. Accessed 17 January 2012.

11 A History of cloud computing [online]. Reed Business Information; March 2009.
URL: http://www.computerweekly.com/feature/A-history-of-cloud-computing.
Accessed 28 December 2011.

12 Levinson, Meredith. Software as a Service (SaaS) Definition and Solutions [online]. CXO Media, Inc; 15 May 2007.

URL: http://www.cio.com/article/109704/
Software_as_a_Service_SaaS_Definition_and_Solutions. Accessed 20 December 2011.

13 Mell, Peter and Grance Timothy. The NIST Definition of Cloud Computing [online]; September 2011. National Institute of Standards and Technology.
URL: http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf. Accessed 29 December 2011.

14 Piech, Mike. Platform-as-a-Service Private Cloud with Oracle Fusion Middleware [online]. Oracle, Inc; October 2009.
URL: http://www.oracle.com/us/technologies/cloud/036500.pdf. Accessed 16 November 2011.

15 Wailgum, Thomas. GE CIO Gets His Head in the Cloud for New SaaS Supply Chain App [online]. CXO Media, Inc; 22 January 2009.
URL: http://www.cio.com/article/477499/
GE_CIO_Gets_His_Head_in_the_Cloud_for_New_SaaS_Supply_Chain_App. Accessed 22 February 2012.

16 Dignan, Larry. Cloud computing market: $241 billion in 2020 [online]. CBS Interactive; 22 April 2011.
URL: http://www.zdnet.com/blog/btl/
cloud-computing-market-241-billion-in-2020/47702. Accessed 4 February 2012.

17 Cloud Computing Takes Off [online]. Morgan Stanley Research; 23 May 2011.
URL: http://www.morganstanley.com/views/perspectives/cloud_computing.pdf. Accessed 31 January 2011.

18 IDC – Press Release [online]. International Data Corporation; 20 June 2011.
URL: http://www.idc.com/getdoc.jsp?containerId=prUS22897311>. Accessed 21 February 2012.

19 Gartner Says Worldwide Cloud Services Market to Surpass $68 Billion in 2010 [online]. Gartner, Inc; 22 June 2010.
URL: http://www.gartner.com/it/page.jsp?id=1389313. Accessed 21 February 2012.

20 Gartner Says Worldwide Software as a Service Revenue Is Forecast to Grow 21 Percent in 2011 [online]. Gartner, Inc; 7 July 2011.
URL: http://www.gartner.com/it/page.jsp?id=1739214. Accessed 21 February 2012.

21 2008 ERP Report, Part II: Comparing Leading Tier I and Tier II ERP Solutions [online]. Panorama Consulting Group, LLC.
URL:<http://panoramaconsulting.com/Documents/
2008_ERP_Report_Part_II.pdf. Accessed 1 February 2012.

22 2010 ERP report: ERP Vendor Analysis [online]. Panorama Consulting Group, LLC.
URL: http://panoramaconsulting.com/Documents/

2010%20ERP%20Vendor%20Analysis%20Report.pdf>. Accessed 1 February, 2012.

23 2011 Guide to ERP Systems and Vendors [online]. Panorama Consulting Group, LLC.
URL: http://panorama-consulting.com/Documents/
2011-Guide-to-ERP-Systems-and-Vendors.pdf. Accessed 1 February 2012.

24 Oracle Information-Driven Support [online]. Oracle, Inc.
URL: http://www.oracle.com/us/support/library/
lifetime-support-applications-069216.pdf. Accessed 9 November 2011.

25 Chan, Steven. Oracle E-Business Suite Release 12.1.1 Now Available [online]. Oracle, Inc; 4 May 2009.
URL: https://blogs.oracle.com/stevenChan/entry/
ebusiness_suite_release_1211_now_available. Accessed 18 February 2012.

26 Chan, Steven. Oracle E-Business Suite Release 12.1.2 Now Available [online]. Oracle, Inc; 17 December 2009.
URL: https://blogs.oracle.com/stevenChan/entry/
ebs_1212_available. Accessed 18 February 2012.

27 Chan, Steven. Oracle E-Business Suite Release 12.1.3 Now Available [online]. Oracle, Inc; 20 August 2010.
URL: https://blogs.oracle.com/stevenChan/entry/
ebs_1213_available. Accessed 18 February 2012.

28 Kanaracus, Chris. Oracle Fusion Applications Are Finally Generally Available [online]. PCWorld Communications, Inc; 5 October 2011.
URL: http://www.pcworld.com/businesscenter/article/241175/
oracle_fusion_applications_are_finally_generally_available.html. Accessed 16 November 2011.

29 From Axapta 1.0 to Microsoft Dynamics AX 2009 [online]. Sycor GmbH.
URL: http://www.sycor.de/en/microsoft_dynamics/cross_industry/axapta.html. Accessed 29 January 2012.

30 Shave, Luke. Press Release: Microsoft Dynamics AX 2012 Launches Worldwide [online]. Microsoft, Inc; 8 September 2011.
URL: http://community.dynamics.com/b/theedge/archive/2011/09/08/
press-release-microsoft-dynamics-ax-2012-launches-worldwide.aspx. Accessed 29 January 2012.

31 SAP's Release Strategy for Large Enterprises [online]. SAP AG; March 2011.
URL: http://www.scribd.com/doc/77987715/
SAP-s-Release-Strategy-for-Large-Enterprises. Accessed 16 February 2012.

32 Jakowski, Jürgen. mySAP ERP – Technology Facts [online]. SAP AG.
URL: https://docs.google.com/
viewer?a=v&q=cache:MBpKKyMRfhMJ:www.erpgenie.com/sap/mysap/images/
mySAPERP%2520%2520Technology%2520Facts%2520%28English%29.ppt+
Jakowski,+J%C3%BCrgen.+mySAP+ERP+%E2%80%93+Technology+Facts&

hl=fi&pid=bl&srcid=ADGEESiBqHSzjuUW2FH1QUfgyAhosrV3gIypm74Wrrv1S9i01
1Ovw2at4S433YQkTSbrHnFFOgdy0OqHhET8NifbVmfnzvptTEc82mgn6qSnboHVRc
FB8s17QOCfqoVoUwW7yddz2vy&sig=AHIEtbRgZBCtj0K4DKsfgPmHm3RuKzuCog.
Accessed 18 February 2012.

33 McIlvaine, Heather. TechEd: EHP 6 for ERP 6.0 [online]. SAP.info; 8 November 2011.
URL: http://en.sap.info/teched-2011-madrid-snabe-keynote/59108. Accessed 21 February 2012.

34 Clash of the Titans: An Independent Comparison of SAP, Oracle and Microsoft Dynamics [online]. Panorama Consulting Group, LLC.
URL: http://panorama-consulting.com/Documents/
Clash-of-the-Titans-2011.pdf. Accessed 2 February 2012.

35 Sap Business Suite [online]. SAP AG.
URL: http://www.sap.com/solutions/business-suite/index.epx. Accessed 22 February 2012.

36 ERP Software from SAP [online]. SAP AG.
URL: http://www.sap.com/solutions/business-suite/erp/index.epx. Accessed 22 February 2012.

37 SAP enhancement packages for SAP ERP: Technology Facts [online]. SAP AG.
URL: http://www.sap.com/argentina/about/events/webinar/pdf/
Enhancement_Packages.pdf. Accessed 29 June 2011.

38 SAP Enhancement Package 5 for SAP ERP: Technology Facts [online]. SAP AG; 20 December 2010.
URL: https://websmp204.sap-ag.de/erp-ehp. Accessed 15 August 2011.

39 SAP Solutions for Small Businesses and Midsize Companies [online]. SAP AG.
URL: http://www.sap.com/sme/solutions/index.epx. Accessed 2 February 2012.

40 Murray, Martin. Introduction to Oracle E-Business Suite (EBS) [online]. About.com.
URL: http://logistics.about.com/od/supplychainsoftware/a/oracle_EBS.htm. Accessed 23 February 2012.

41 Chan, Steven. Apps 12.0.1 Release Update Pack Now Available [online]. Oracle, Inc; 26 April 2007.
URL:https://blogs.oracle.com/stevenChan/entry/
apps_1201_release_update_pack. Accessed 18 February 2012.

42 Chan, Steven. Glimpses of E-Business Suite 12.2: WebLogic Server and Online Patching [online]. Oracle, Inc; 7 June 2011.
URL: https://blogs.oracle.com/stevenChan/entry/
glimpses_of_e_business_suite. Accessed 22 February 2012.

43 Robb, Drew. An In-Depth at Oracle Fusion Applications [online]. QuinStreet, Inc; 10 October 2011.

URL: http://www.enterpriseappstoday.com/crm/
oracle-fusion-applications-in-depth-1.html. Accessed 13 November 2011.

44 Oracle Fusion Applications: The New Standard for Business [online]. Oracle, Inc.
URL: http://www.oracle.com/us/products/applications/fusion/
oracle-fusion-apps-solution-brief-173003.pdf. Accessed 14 November 2011.

45 Jacobson, Simon, Prescott, Miles. Awakening a Sleeping Giant: Inside Microsoft Business Solutions' ERP Strategy [online]. AMR Research, Inc; August 2008.
URL: http://www.microsoft.com/presspass/itanalyst/
docs/08-01-08AMRResearch.PDF. Accessed 27 November 2011.

46 Mehling, Herman. What's New In Microsoft Dynamics AX 2012 ERP? [online]. QuinStreet, Inc; 28 July 2011.
URL: http://www.enterpriseappstoday.com/erp/
whats-new-in-microsoft-dynamics-ax-2012.html. Accessed 22 February 2012.

47 Kanaracus, Chris. Microsoft Putting ERP in the Azure Cloud [online]. CXO Media, Inc; 11 April 2011.
URL: http://www.cio.com/article/679360/
Microsoft_Putting_ERP_in_the_Azure_Cloud?page=1&taxonomyId=3000. 23 February 2012.

48 Horowitz, Brian T. Microsoft Azure Cloud Platform Powers EmblemHealth Mobile Apps [online]. Ziff Davis Enterprise Holdings, Inc; 18 July 2011.
URL: http://www.eweek.com/c/a/Mobile-and-Wireless/
Microsoft-Azure-Cloud-Platform-Powers-EmblemHealth-Mobile-Apps-403502/. Accessed 23 February 2012.

49 (Author Classified). HCM EhPx – New Functionality Analysis & Planning [Classified PowerPoint Document]. TeliaSonera, Inc. Accessed 3 January 2012.

50 Oval, Francois, Schwirtz, Lionel. Enterprise Support [online]. SAP AG.
URL: http://www.sap.com/community/webcast/2009_06_worldtour_fr/
2009_06_Worldtour_SOL22_SAP_fr.pdf. Accessed 17 February 2012.

51 Kehinde, Eseyin. Understanding the SAP System Landscape [online]. Ziff Davis Media; 20 January 2007.
URL: http://it.toolbox.com/blogs/sap-library/
understanding-the-sap-system-landscape-14030. Accessed 17 February 2012.

52 (Author Classified). HCM Enhancement Pack 5: Benefit and Cost Analysis [Classified PowerPoint Document]. TeliaSonera, Inc. Accessed 11 February 2012.

53 (Author Classified). EhP New Functionality List Business Benefits [Classified Excel Document]. TeliaSonera, Inc. Accessed 11 February 2012.

54 Lang, Sven. SAP Enhancement Package 5 for SAP ERP Release Cookbook [online]. SAP AG; 11 May 2010.
URL: https://websmp101.sap-ag.de/~form/
sapnet?_SHORTKEY=01100035870000708115&. Accessed 28 January 2012.

55 Leoni, Marcio, Campbell, Stuart. Getting Started in ESS [online]. SAP Community Network; 30 September 2010.
URL: http://wiki.sdn.sap.com/wiki/display/ERPHCM/Getting+Started+in+ESS. Accessed 15 February 2012.

56 Note 1450179 – ESS Based on Web Dynpro ABAP Available as of EHP5 [online]. SAP AG; 19 March 2010.
URL: http://help.sap.com/ERP2005_EHP_05/helpdata/EN/06/21FE58443949769EA924C9A8A1D8DE/frameset.htm. Accessed 12 February 2012.

57 What's new in ESS SAP Enhancement Package 5 for SAP ERP [online]. SAP AG.
URL: http://nicx.co.uk/attachments/File/ESS.pdf. Accessed 12 December 2011.

58 HCM, ESS on Web Dynpro ABAP [online]. SAP AG.
URL: http://help.sap.com/ERP2005_EHP_05/helpdata/EN/06/21FE58443949769EA924C9A8A1D8DE/frameset.htm. Accessed 12 February 2012.

59 SAP Enhancement Package 6 for SAP ERP: Human Capital Management Enhancements [online]. SAP AG; November 2011.
URL: https://websmp101.sap-ag.de/~form/sapnet?_SHORTKEY=01100035870000708115&. Accessed 14 February 2012.

60 Business Function HCM, PD UI Visualization 01 [online]. SAP AG.
URL: https://websmp101.sap-ag.de/~sapidb/011000358700000904262010/. Accessed 28 January 2012.

61 SAP Manager Self-Service [online]. SAP AG.
URL: https://websmp101.sap-ag.de/IBC-MSS. Accessed 19 February 2012.

62 SAP Visualization [online]. Nakisa, Inc.
URL: http://www.nakisa.com/solutions/solutions-platform/sap-visualization/overview.htm. Accessed 11 February 2012.

63 HCM, PD UI Visualization 01 [online]. SAP AG.
URL: http://help.sap.com/erp_mss_addon10/helpdata/en/40/0f88eb6ff448aa8597211c15a5a653/content.htm. Accessed 12 February 2012.

64 Startegy [online]. TealiSonera, Inc.
URL: http://www.teliasonera.com/en/about-us/strategy/. Accessed 16 February 2012.

65 FIN_Travel_1: New Features [online]. SAP AG.
URL: http://www.scribd.com/doc/65351775/FIN-Travel-1. Accessed 15 February 2012.

66 HCM, Enterprise Compensation Management 01 [online]. SAP AG.
URL: https://websmp101.sap-ag.de/~sapidb/011000358700001954902008/. Accessed 16 February 2012.

67 Business Function HCM, Enterprise Compensation Management 02 [online]. SAP AG.
URL: https://websmp101.sap-ag.de/~sapidb/011000358700000904072010/
Accessed 16 February 2012.

68 HCM, Enterprise Compensation Management 01 [online]. SAP AG.
URL: http://help.sap.com/erp_mss_addon10/helpdata/en/40/
2facbf8e5846969b432f9e80083e2a/content.htm . Accessed 16 February 2012.

Appendix 1. Predicted revenues of SaaS

Performance Management, Customer Service and Support, and Collaboration Are Most Attractive Market Segments for Growth

	Total SaaS rev. ($ mil.)		SaaS as % of market		SaaS rev. CAGR		
	2010	2015e	2010	2015e	2010-2015e	Leading beneficiaries	Emerging beneficiaries
Customer Relationship Management							
Sales force automation	1,959	3,333	44	50	11	Salesforce	MSFT, N, ORCL
Marketing automation	237	458	11	14	14	ADBE, CTCT	RNOW, CRM
Customer service and support	418	898	12	20	17	RNOW, Salesforce	
Total CRM SaaS	**2,614**	**4,689**	**26**	**32**	**12**		
Human Capital Management							
Performance management	232	548	37	63	19	SFSF	TLEO, KNXA, CSOD
E-recruiting	346	563	56	70	10	TLEO, KNXA	SFSF
E-learning	153	229	21	26	8	TLEO, CSOD, SFSF (Plateau	SABA
Other SaaS HCM	149	337	3	6	18	SFSF, TLEO	ULTI
Total HCM SaaS	**879**	**1,677**	**14**	**21**	**14**		
Enterprise Resource Planning							
Financial management systems	427	687	5	6	10	N, INTU	SAP, MSFT
Other ERP	62	82	1	1	6	N, INTU	SAP
Total ERP SaaS	**489**	**769**	**3**	**4**	**9**		
Other Markets							
Content, communication and collaboration	2,855	7,003	33	46	20	IL, ADBE, MSFT	
Supply chain management	912	1,535	14	16	11	DMAN	

Figure 18. Predicted revenues of SaaS. Data copied from Cloud Computing Takes Off (2011) [17, 66]

Appendix 2. Not updated functionalities: version 1

NOT UPDATED First Version

- HCM, Roles for SAP Netweaver Business Client (EHP5)
- Employee Self Services on Web Dynpro ABAP (EHP5)
- HCM, Localization Topics for India (EHP5)
- HCM, Localization Enhancements for NPO (EHP5)
- HCM, Supplementary Pension for Italy and Reporting Parallezation (EHP5)
- HCM, Reconciliation Localization for NO, SE and FI (EHP5)
- HCM, Localization of Payroll for Chile (EHP5)
- HCM, Localization India for PS - Alternate Financial Year (EHP5)
- HCM, Rehiring Following Retirement Topics for Japan (EHP5)
- HCM, Localization Topics for Spain and Italy (EHP5)
- HCM, Localization for CA, CN, FI, IN, IE, and TW (EHP5)
- HCM, Localization of Concurrent Employment for Russia (EHP5)
- HCM, Payroll and Travel Management Topics for Russia (EHP5)
- HCM, Localization of Public Sector Topics for Portugal (EHP5)
- HCM, Localization Topics for India and Japan (EHP5)
- HCM, Localization of Public Sector Topics for Italy (EHP5)
- HCM, Performance Management 02 (EHP5)
- HCM, Core Processes in Talent Management 02 (EHP5)
- HCM, Learning Solution 03 (EHP5)
- HCM, SAP E-Recruiting 4 (EHP5)
- HCM, Enterprise Compensation Management 02 (EHP5)
- Travel Management 3 (EHP5)
- Travel Management, Third-Party Travel Planning (EHP5)
- Travel Management, Enablement for Shared Services (SSC) (EHP5)
- HCM, Employee Shared Service Center 01 (SCC) (EHP5)
- HCM Cross Analytics 1 (EHP5)
- HCM, Enterprise Services 02 (EHP5)
- HCM, Time Management & Travel Management (Mobile) (EHP5)
- HCM, PD UI Visualization 01 (EHP5)
- HCM, Personnel Cost Planning and Simulation (EHP5)
- HCM, Administrative Services 03 (EHP5)
- CRM, Time Recording Using Multiple CATS Data Entry Profiles (EHP5)
- HCM, Hire Integration 1 (EHP5)

- HCM, Employee Interaction Center 02 (EHP4)
- HCM Localization Topics for Russia (EHP4)
- HCM Localization Topics for Japan (EHP4)
- HCM Localization Topics for the Italian Public Sector (EHP4)
- HCM Localization Topics for Spain (EHP4)
- HCM Localization Topics for the Swedish Public Sector (EHP4)
- HCM Localization Topics for Norway (EHP4)
- TNM/LSO Integration (EHP4)
- CA, Evaluations, Appraisals, and Surveys 01 (EHP4)
- CA, Employee Qualifications for Concurrent/Global Employment (EHP4)
- CATS classic for Concurrent Employment (EHP4)
- HCM, Personnel Actions for Concurrent Employment (EHP4)
- HCM, Time and Labor Management for Concurrent Employment (EHP4)

- SAP All-In-One Roles (EHP3)
- CATS regular: cProjects Details (EHP3)
- CATS classic: cProjects Details (EHP3)
- HCM, ESS for Concurrent Employment and Global Employment (EHP3)
- HCM, ESS for Personal Information (EHP3)
- HCM Localization Topics (EHP3)
- HCM, SAP E-Recruiting Search Functions 1 (EHP3)
- HCM, MSS for SAP E-Recruiting (EHP3)
- HCM, Talent Management Analytics 1 (EHP3)

- HCM, Enterprise Learning (EHP2)

Appendix 3. Not updated functionalities: version 2

Appendix 4. Interview questions to TS's representative on January 23, 2012

1. The current situation: Is the functionality related SAP ERP 6.0 back-end component utilized at TS now? (Yes = 50 points; No = 25 points)

2. The situation on the roadmap: Where is the functionality located on the TS's roadmap? (In the beginning of 2012 = 20 points; In the end of 2012 = 15 points; during 2013 = 10 points; during 2014 = 5 points)

3. The active users and utilization rate: What employees of TS would use the functionality with SAP ERP 6.0 and how often in the table below? (The absolute minimum scores = 0 points; The absolute maximum scores = 49 points)

Target group	**Daily**	**Sometimes**	**Monthly**	**Rarely**
HR Key Users (around 10 Emp.)	4p	3p	2p	1p
Other HR Personnel (around 100 Emp.)	8p	4p	3p	2p
Supervisors (around 1800 emp.)	12p	8p	4p	3p
All Employees (around 15000 emp.)	25p	16p	10p	7p

4. The implementation effort: How long does it take to implement the functionality to the TS's production environment assuming that the implementation project team is constant? (Less than month = 5 points; 1-2 months = 4 points; 2-4 months = 3 points; over 4 months = 2 points